UNITED STATES ATOMIC ENERGY COMMISSION

NUCLEAR SCIENCE ABSTRACTS

Volume 14

Numbers 7 - 12A

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~~January~~ apr. - June

1960

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NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 7 April 15, 1960

GENERAL AND MISCELLANEOUS

6071 AECU-4525

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PROGRESS REPORT [NO. 54 COVERING THE PERIOD FOR PHYSICS AND CHEMISTRY THROUGH APRIL 30, 1959]. May 1, 1959. 167p. Contracts AT(30-1)-2098; NASw-37; and AT(30-1)-905. OTS.

Chemistry of the Fission Elements Group: Current progress on fourteen problems currently under study in this group is outlined. The investigations deal either with chemical studies or the development of instrumental methods. Chemically oriented problems include studies on mixed ligand complexes, lower valence states of In, and polytungstate equilibria. Theoretical and instrumental investigations are represented by studies on flame photometry, photometric titrations, fused salt systems, thermometric titrations, coulometry, irreversible electrochemical reactions, and absorption and luminescence spectra of chelates. Nuclear Chemistry (Inorganic) Group: New information is presented on twenty problems in the following categories: physicochemical studies; solvent extraction studies; ion exchange studies; general nuclear chemistry; and fission radiochemistry. The physicochemical studies are extending over a wider front while still probing deeply into electrolyte invasion of ion-exchange resins at low external electrolyte concentration. Nuclear Chemistry (Organic) Group: Investigations reported on include; mechanism of substitution of triphenyl-methyl halides in benzene, interchange of oxygens in triphenylmethyl benzoate, methyl halide ground states in water solution, solvent isotope effect in solvolysis of benzoyl chlorides, isotopes effects in the general base-catalyzed term in mutarotation of glucose, solvent isotope effect in ion-recombination reactions, effect of acid concentration on the rate of racemization of D-α-phenylisocaprophenone in concentrated $H_2SO_4-H_2O$ mixtures, mechanism of the Cannizzaro reaction, tritium isotope effect in the reaction of benzoyl peroxide with hexaphenylethane in benzene-t, stereospecificity in free radical reactions, the nature of the O-O bond, and selectivity in carbene reactions. Cosmic Ray Group: Investigations reported on include; high-counting meson monitor, large air shower experiment, India air shower experiment, polarization of cosmic muons, plasma probe studies, space charge distribution near conducting surface due to solar photoeffect and plasma winds, cosmic gamma-ray experiments, and gamma-ray satellite experiment. High Energy Accelerator Physics Group: Synchrotron operation and maintenance are summarized. Research programs included study of π^- capture in complex nuclei, single quantum annihilation of positrons, neutral meson production from complex nuclei, measurement of the Panofsky ratio, theory of nuclear forces, search for $\pi^0 \rightarrow 3\gamma$, triggered spark counter, γ-counter development, hodoscope, and Λ^0 gyromagnetic ratio. Cambridge Bubble Chamber Group: The efforts of the bubble chamber group were directed primarily toward designing and building equipment to be used with high-energy accelerators which will be operating in the near future. One program was concerned with preparing the 15" heavy liquid chamber for operation with the Cosmotron. Another project was to investigate what can be done to adapt bubble chambers to machines which produce high-energy gamma rays. Plans for a large liquid hydrogen bubble chamber are being completed and some experiments on the expansion system to be used with this instrument were carried out. Linear Accelerator Group: Various preliminary experiments were carried out on the measurement of the photoneutron spectra from Be^9, the most favorable experimental geometry was fixed, and serious data taking begun. An investigation was successfully completed which proved the feasibility of using amplitron tubes to provide the microwave power for the linear accelerator. Rockefeller Generator Group: The work of the group was concerned with the adaptation of the generator to pulsed operation and preparation of experimental equipment. ONR Generator Group: The group continued its program of high-resolution nuclear spectroscopy and considerable progress was made in the improvement of existing equipment and the development of new apparatus. Radioactivity Group: The program of measuring magnetic moments of radioactive nuclei has begun to yield significant results. Two nuclear spectroscopy programs were started. The first is an investigation of the coincident radiation emitted by short-lived isotopes and by compound nuclei formed by neutron capture. The second program is a study of the lifetime of excited states of nuclei by the resonance scattering process. Cyclotron Group: The main activity of the group was the study of various alpha-induced reactions. A series of elastic deuteron scattering experiments was completed and the data analyzed. Theoretical Group: Work by the theoretical group is reported on fundamental field theory, particles with spin higher than $\frac{1}{2}$, meson theory, scattering of light in protons, theory of nuclear reactions, theory of deformed nuclei, and multi-particle problems. (For preceding period see AECU-3906.) (W.D.M.)

6072 AERE-Bib-127

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

LIST OF UNCLASSIFIED REPORTS AND PAPERS PUBLISHED BY STAFF OF THE ISOTOPE DIVISION SINCE 1950. R. J. Millett and E. J. Wilson, comps. Sept. 1959. 37p. BIS.

A listing of all unclassified reports and papers published by the isotope division between 1950 and Sept. 1959 is presented. The items are listed alphabetically by first author and chronologically within that system. A subject and author index are included. (J.R.D.)

6073 AGC-1728

Aerojet-General Corp., Azusa, Calif.

CHARGED-COLLOID PROPULSION SYSTEM. R. D. Schultz and L. K. Branson. Dec. 1959. 34p. Project No. 4766. Contract AF49(638)-656.

Theoretical and experimental research is described leading toward a space propulsion system in which microscopic oil droplets are produced with a high positive charge and accelerated electrostatically to exhaust velocities of over 50,000 miles per hour with a specific impulse of over 2200 seconds. This type of rocket system may prove to be of considerable value for controlling the orbit of an earth satellite, for earth-moon missions, and possibly for deep-space exploration such as a Mars or Venus probe. (auth)

6074 SCTM-385-59(51)

Sandia Corp., Albuquerque, N. Mex.

THE POSSIBILITIES OF REDUCING NEUTRON-INDUCED CONTAMINATION OF UNDERGROUND BURSTS. J. R. Banister. Aug. 1957. Reprinted with deletions Nov. 24, 1959. 12p. OTS.

Possibilities of reducing neutron-induced activities in soil in underground nuclear bursts are considered. The shield material examined, a slurry of boric acid in water, proved tentatively effective. Complications introduced by neutron heating and absorber depletion in the innermost shield portion remain to be fully examined. (auth)

6075

A NOVEL SYSTEM FOR SPACE FLIGHT USING A PROPULSIVE FLUID ACCUMULATOR. Sterge T. Demetriades (Northrop Corp., Hawthorne, Calif.). J. Brit. Interplanet. Soc. 17, 114-19(1959) Sept.-Oct.

A propulsion system for spaceflight is described which, by collecting and storing gases in the upper atmosphere of a planet and by using these gases as a propulsive fluid (in conjunction with a power source), can bring about significant decreases in the required take-off mass. (auth)

6076

SOME REMARKS ON FREE RADICALS AND THEIR POSSIBLE USE IN ROCKET PROPULSION. Olgierd Wołczek. J. Brit. Interplanet. Soc. 17, 133-6(1959) Sept.-Oct.

The possibilities of using nuclear and corpuscular nonnuclear radiations for producing free radicals for use in rocket propulsion are examined. The use of beta and alpha rays from isotopes and of radiation produced inside nuclear fission reactors are considered. (auth)

6077

GEOMAGNETIC EFFECTS OF HIGH-ALTITUDE NUCLEAR EXPLOSIONS. A. G. McNish (National Bureau of Standards, Washington, D. C.). J. Geophys. Research 64, 2253-65(1959) Dec.

Two high-altitude nuclear explosions detonated near Johnston Island in August 1958 produced distinct geomagnetic effects at Honolulu, Palmyra Island, Fanning Island, Jarvis Island, and Apia. The effects at the first four observatories are attributed to overhead currents caused by increased ionization of the atmosphere by γ rays and their secondaries from the detonations. The effects at Apia are attributed to charged particles from the detonations and Compton electrons released from the air around the detonation. (auth)

6078

ARTIFICIAL AURORAS RESULTING FROM THE 1958 JOHNSTON ISLAND NUCLEAR EXPLOSIONS. J. M. Malville (Univ. of Colorado, Boulder). J. Geophys. Research 64, 2267-70(1959) Dec.

Beta decay electrons traveling along magnetic lines of force are shown to be capable of accounting for the artificial aurora which appeared at the conjugate point of Johnston Island after the explosion of August 1. Dissociative recombination and ion-atom interchange are suggested as the primary exciting mechanisms of the oxygen forbidden lines in the artificial auroral rays and may account, when combined with collisional de-excitation, for the observed violet color of the rays. The high-altitude ar may be a form of auroral afterglow and may result from a process similar to that which enhances the oxygen red lines in twilight. (auth)

6079

EFFECTS OF HIGH-ALTITUDE NUCLEAR EXPLOSIONS ON RADIO NOISE. C. A. Samson. J. Research Natl. Bur. Standards 64D, No. 1, 37-40(1960) Jan.-Feb.

High-altitude nuclear explosions over Johnston Island in August 1958 appear to have had a rather pronounced effect on the radio noise recorded at Kekaha, Hawaii. Graphs are presented showing the hour-to-hour variation of the noise during August at eight frequencies from 13 to 20 Mc. All frequencies seem to have been affected, and the drop in received noise power amounted to as much as 32 db in the hour following the first explosion. The period of time over which abnormal noise conditions were observed suggests that high-altitude nuclear explosions may have a rather persistent effect on radio communications at certain frequencies. (auth)

6080

INTERNATIONAL DIRECTORY OF RADIOISOTOPES. VOLUME 1. UNPROCESSED AND PROCESSED RADIOISOTOPE PREPARATIONS AND SPECIAL RADIATION SOURCES. ADDENDUM. Vienna, The International Atomic Energy Agency, 1959. 4p.

An addendum is presented which covers the sources of processed and special preparations of radium for medical, industrial, or scientific use. (Vol. I is abstracted as NSA, 13-20782). (C.J.G.)

6081

INTERNATIONAL DIRECTORY OF RADIOISOTOPES. VOLUME II. COMPOUNDS OF CARBON 14, HYDROGEN 3, IODINE 131, PHOSPHORUS 32 AND SULPHUR 35. Vienna, The International Atomic Energy Agency, 1959. 216p. $3.00.

The specific activity, the cost (per 1.0, 0.5, 0.1, and 0.05 mc), and the suppliers of chemical compounds labeled with C^{14}, I^{131}, P^{32}, S^{35}, and tritium are given. (C.J.G.)

6082

EXPERIMENTAL RESULTS WITH COLLINEAR ELECTRODE PLASMA ACCELERATOR AND A COMPARISON WITH ION ACCELERATORS. Presented at the ARS 14th Annual Meeting, Washington, D. C., November 16-20, 1959. S. W. Kash and W. L. Starr (Lockheed Aircraft Corp., Sunnyvale, Calif.). New York, American Rocket Society, 1959. 30p.

A description and the performance of a collinear electrode plasma accelerator using either plasma derived from an exploding wire or from electrode erosion are given. Maximum particle velocities approaching 10^7 cm/sec and impulses of 2×10^3 dyne·sec were achieved. Effective specific impulses, computed from measured

impulse and propellant mass, greater than 2000 sec were obtained for exploding wire measurements. For certain conditions of operation the efficiency is greater than 30%. Efficiencies of 50% or more should be possible. The practicality of deriving the plasma by electrode erosion is demonstrated and effective specific impulses of about 6000 sec are indicated. The dependence of the efficiency, mass flow rate and specific impulse on the thrust per unit area (T_{sp}) is discussed. Because of voltage and geometric considerations (T_{sp}) for the plasma accelerator can be at least two orders of magnitude greater than that for the ion accelerator. The limitation on (T_{sp}) for the ion accelerator cannot be circumvented by use of either a double-grid accelerate-decelerate system or by the use of a heavy charged particle accelerator. (auth)

BIOLOGY AND MEDICINE

General and Miscellaneous

6083 AECU-4618

Chicago. Univ.

RADIOACTIVE DRUG RESEARCH. Final Summary Report [for] July 1949 to October 1959. E. M. K. Geiling and L. J. Roth. Jan. 15, 1960. 26p. Contract AT(11-1)-45. OTS.

Applications of radioisotopes in the preparation of labeled drugs are reviewed. Among the applications described are the preparation of carbon-14-labeled cardiac glycosides, and the biosynthesis of carbon-14-labeled digitoxin, morphine, colchicine, atropine, podophyllotoxin, and nicotine. The fate and metabolism of many of these drugs were traced. Radiochemical procedures were developed for the synthesis of pure compounds of pharmacological interest labeled with carbon-14, sulfur-35, and tritium. Investigations were made on the phenomena of drug penetration into the central nervous system. Publications during the period are listed. (C.H.)

6084 AMRL-407

Army Medical Research Lab., Fort Knox, Ky.

SYNERGISTIC EFFECT OF CERTAIN RADIOPROTECTIVE COMPOUNDS. Richard I. H. Wang, James G. Kereiakes, Ronald R. Anderson, and A. T. Krebs. Sept. 23, 1959. 16p. Project No. 6X64-14-001-03.

When single doses of 10 μM serotonin, or 20 μM S, β-aminoethylisothiuronium (AET), or 30 μM β-mercaptoethylamine (MEA) were given alone to mice preceding exposure to a lethal dose of 800 r x ray, 50 to 65% protection was observed. At 1100 r, no protection was found. The optimal time interval between drug administration and radiation exposure at 800 r was 10 min for 20 μM AET or 30 μM MEA and 30 min for 10 μM serotonin. When mixtures of the above agents (5 μM serotonin plus 10 μM AET or 5 μM serotonin plus 30 μM MEA) were administered, 100 per cent and 70 to 80 per cent protection were obtained in mice exposed to 800 r and 1100 r, respectively. Mixtures of AET and MEA failed to produce appreciable protection. (auth)

6085 USNRDL-TR-376

Naval Radiological Defense Lab., San Francisco.

ACCEPTANCE OF RAT AND MOUSE LUNG GRAFTS BY RADIATION CHIMERAS. G. W. Santos, R. M. Garver, and L. J. Cole. Oct. 12, 1959. 19p.

Rat-mouse bone marrow chimeras, i.e., lethally x-irradiated mice which had been injected with rat bone marrow, were given grafts of rat and mouse lung tissue, by subcutaneous implantation at 14 to 270 days post-irradiation. The lung grafts were removed 35 to 40 days after implantation, fixed in formalin, and the histological sections examined microscopically for evidence of growth and persistence of the graft, or of rejection. In normal non-irradiated mice or in isologous chimeras, the mouse lung grafts grew well in 73% of the recipients, while rat lung grafts were rejected in 100% of the animals. In the heterologous chimeras, rat lung grew well in 56% of the animals, while mouse lung grew well in only 19% (16 mice, 14 to 39 days post irradiation). In heterologous chimeras (19 mice) grafted 55 to 270 days post-irradiation, rat lung grafts grew well in 58%, and mouse lung in 69% of the mice. In one chimera which lost its rat marrow graft at 60 days post-irradiation (as evidenced by the absence of alkaline-phosphatase positive rat granulocytes in the peripheral blood), mouse lung grew well, but rat lung was rejected. The significance of these observations, with respect to the immunological status of rat-mouse chimeras, and the problem of secondary disease was discussed. (auth)

6086 USNRDL-TR-377

Naval Radiological Defense Lab., San Francisco.

SPECIES DIFFERENCES IN ALTITUDE TOLERANCE FOLLOWING X-IRRADIATION. B. D. Newsom and D. J. Kimeldorf. Oct. 27, 1959. 14p.

The relationship between altitude tolerance and food consumption was investigated in irradiated and non-irradiated animals of several species. Food consumption was measured for three days following a mid-lethal dose of x irradiation to assess the degree of post-irradiation anorexia. Seventy-two hours after irradiation those animals, as well as ad lib. fed and food deprived non-irradiated animals, were exposed to a simulated altitude tolerance test. The mortality produced in four hours was used as the criterion of hypoxic tolerance for each species. Irradiated rabbits and rats exhibited a severe decrease in food consumption and an increased hypoxic tolerance. Food consumption of mice was depressed during the three days following irradiation although the effect was much less than that observed for rats and rabbits. Guinea pigs and hamsters exhibited a slight decrease in food consumption with recovery occurring after 24 hours. Mice, guinea pigs, and hamsters did not exhibit a significant increase in hypoxic tolerance three days after radiation exposure. When non-irradiated rabbits, rats, mice, and guinea pigs were food deprived, the hypoxic tolerance was significantly increased in all species. These observations provide further evidence that the post-irradiation increase in tolerance to simulated altitude is dependent upon the degree of post-irradiation anorexia. (auth)

6087 UCRL-Trans-106

THE INFLUENCE OF BORON ON THE DEVELOPMENT OF PLANTS DEPRIVED OF ROOTS. M. Kh. Chailakhyan. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Doklady Akad. Nauk S.S.S.R. 77, 1115-18 (1951). 10p. JCL or LC.

6088 UCRL-Trans-108

ABOUT THE POSSIBILITY OF THE APPLICATION OF COLOR REACTION ON CAROTINOIDS IN PLANT TISSUES. E. V. Budnitzkaya and K. E. Ovcharov. Translated from Doklady Akad. Nauk S.S.S.R. 74, 779-80(1950). 3p. JCL or LC.

A method is described for the detection of carotinoids directly in slices of plant tissue by a colorimetric method employing a saturated solution of antimony trichloride in chloroform. A blue or blue-green color develops in the presence of carotene pigments. (C.H.)

6089 UCRL-Trans-113
ON NUCLEIC ACID AND OTHER FEULIGEN POSITIVE PROTEINS IN BLOOD SERUM. Susumu Ohno, Goro Adachi, and Yoshimi Suzuki. Translated for Univ. of California Radiation Lab. from Igaku to Seibutsugaku 17, 280-2 (1950). 4p. JCL.

Results are reported from an analysis of swine blood serum for nucleic acid content. An attempt was made to isolate histone, but none was found. The desoxyribonucleic acid of swine blood serum was not easily separated from the protein fraction. Reaction mechanisms involved in the combination of nucleic acid with albumin in swine blood serum are discussed. (C.H.)

6090 UCRL-Trans-116
FURTHER INVESTIGATION OF THE PRODUCTS OF REDUCTION OF CARBON DIOXIDE BY CHLOROPLASTS. E. A. Bolchenko. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Doklady Akad. Nauk S.S.S.R. 70, 1037-40(1950). 7p. JCL or LC.

6091 UCRL-Trans-118
DEPENDENCE OF THE ABSORPTION OF RADIANT ENERGY BY LEAVES ON PHOTOSYNTHESIS. L. Bell. Translated by Sergey Shewchuck (Univ. of California Radiation Lab.) from Doklady Akad. Nauk S.S.S.R. 83, 477-80 (1952). 7p. JCL or LC.

Results are reported from a study of the influence of the amount of radiant energy absorbed by a leaf on the intensity of photosynthesis. Mechanisms involved in the utilization of light energy by green plants are discussed. (C.H.)

6092 UCRL-Trans-124
A METHOD OF STORING ISOLATED CHLOROPLASTS WITHOUT ALTERING THEIR PHOTOCHEMICAL ACTIVITY. I. V. Vereschinskii (E. V. Vereschinski). Translated by Sergey Shewchuck (Univ. of California Radiation Lab.) from Biokhimiya 16, 350-1(1950). 3p. JCL or LC.

A method is described for the preparation and storage in liquid air of isolated chloroplasts. No reduction in photochemical activity was noted in chloroplasts stored for 13 days. (C.H.)

6093
TUMOR FORMATION BY IMPLANTATION OF THE ESTABLISHED HUMAN AMNION TISSUE CULTURE CELL LINE "H" IN X-IRRADIATED AND CORTISONE TREATED RATS. Isamu Kitamura (Okayama Univ., Medical School, Japan). Gann 50, 227-31(1959) Sept.

Human amniotic cells originally derived from normal persons produced tumors on transfer into the x-irradiated and cortisone treated rats. Similar results were obtained with HeLa cells. Recultivation of tumors or passage into subsequent series of rats were made. Immunocytopathogenic effect of anticellular sera attested to the human nature of tumor cells regrown in the culture with positive results. (auth)

6094
HORMONE EFFECTS ON EARLY DISTRIBUTION AND DISAPPEARANCE FROM THE BLOOD OF PROMETHIUM-147 IN RATS. Bergene Kawin (Michigan State Univ., E. Lansing). Nature 184, Suppl. 23, 1816-17(1959) Dec. 5.

Growth hormones and cortisone decreased the uptake of promethium-147 by liver and bone in rats. Data are tabulated. Possible applications in altering the potential toxicity hazards of fission products are discussed briefly. (C.H.)

6095
FATE OF THE HIGHLY POLYMERIZED SPLEEN DEOXYRIBONUCLEIC ACID LABELLED WITH PHOSPHORUS-32 INJECTED INTRAPERITONEALLY INTO RATS. Tamara A. Hudnik-Plevnik, Vladimir R. Glisin, and Marta M. Simić ("Boris Kidrich" Laboratory of Radiobiology, Inst. of Nuclear Sciences, Belgrade). Nature 184, Suppl. 23, 1818-19 (1959) Dec. 5.

Results are reported from an investigation of the mechanisms involved in the protection against radiation injuries afforded by highly polymerized rat spleen and liver desoxyribonucleic and ribonucleic acids. Nucleic acids labeled with phosphorus-32 were used as tracers in the study. (C.H.)

6096
SCINTILLATION SCANNING OF THE NORMAL HUMAN SPLEEN UTILIZING SENSITIZED RADIOACTIVE ERYTHROCYTES. Philip M. Johnson, John C. Herion, and Stewart L. Mooring (Univ. of North Carolina, Chapel Hill). Radiology 74, 99-101(1960) Jan.

A method is described for the scintillation scanning of the normal spleen following its differential concentration of gamma-emitting red cells. (C.H.)

6097
SURVIVAL OF THE RED BLOOD CELLS OF BLOOD TREATED WITH GENTIAN VIOLET. ITS IMPORTANCE IN THE PROPHYLAXIS OF CHAGAS DISEASE TRANSMITTED DURING TRANSFUSION. V. Maspes, R. R. Pieroni, and O. Mellone. Sangre 4, 45-50(1959). (In Spanish)

The utility of adding gentian violet to blood to be transfused for prophylaxis of Chagas disease is discussed. It is quite useful in regions where a high percentage of blood donors are infected. The survivial of the erythrocytes in blood treated with sufficient gentian violet to kill Trypanosoma Cruzi (1:4,000) is studied. The study was made at 4°C with chromium as the labeling substance. Mean cell life values found varied from 66 to 91 days. It was concluded that other properties of erythrocytes are not significantly changed. Therefore, the wide use of gentian violet in the prophylaxis of Chagas disease is recommended. (auth)

6098
IMPROVEMENTS IN OR RELATING TO RADIOLOGICAL IRRADIATION APPLIANCES. (to Dr. E. Uhlhorn and Co.). British Patent 818,688. Aug. 19, 1959.

A radiotherapy device is described. It has a motor driven rotating source holder and can use any type of source which is attachable to the holder. Several configurations are offered so that irradiation of brain tumors, tumors of neck, nose, and ears, and gynecological irradiation are all possible with one basic device. (T.R.H.)

Fallout and Radiation Ecology

6099 AECU-4616
Isotopes, Inc., Westwood, N. J.
STUDIES OF NUCLEAR DEBRIS IN PRECIPITATION. Second Quarterly Progress Report. Dec. 15, 1959. 26p. Contract AT(30-1)-2415. OTS.

A sequential method is described for the determination of strontium-89, strontium-90, barium-140, and tungsten-185 in rain water samples. A comparison is made of data on radioactivity in individual rain samples and in monthly pot samples. Data are included on the total strontium-90 fall-out collected in steep walled stainless steel pots during the period. Results are compared with cumulative data for 1958 and 1959. (C.H.)

6100 FFIK-IR-K-219
Norway. Forsvarets Forskningsinstitutt, Oslo.
RADIOCHEMICAL ANALYSIS OF PRECIPITATION, TAP WATER AND MILK IN NORWAY, 1957-1958: METHODS,

RESULTS AND CONCLUSIONS. H. Bergh, G. Finstad, L. Lund, O. Michelsen, and B. Ottar. July 1959. 151p.

Radiochemical investigations of precipitation, tap water, and milk conducted at the Norwegian Defence Research Establishment, Division for Chemistry, up to the end of 1958, are described. Data for Sr^{90}, Sr^{89}, Cs^{137}, and I^{131} are given and the theories for the distribution of these isotopes in the biosphere are discussed. An account is given of radiochemical experiments carried out and the methods of radiochemical analysis are given in detail in Appendix I and II. (auth)

6101 HASL-57

New York Operations Office. Health and Safety Lab., AEC. THE SEQUENTIAL ANALYSIS OF TEN NUCLIDES OCCURRING IN LONG RANGE FALLOUT DEBRIS. George A. Welford, William R. Collins, Jr., Doris C. Sutton, and Robert S. Morse. Mar. 4, 1959. 43p. OTS.

Methods for the chemical separation of strontium, barium, cesium, cerium, yttrium, zirconium, niobium, and tungsten from complex matrices are described. Procedures for the radiometric determination of the longer-lived isotopes of these elements are outlined. Inert carriers are added and the sample is dissolved by fusion with sodium carbonate. The melt is leached first with water and then with hydrochloric acid. The elements are recovered from these fractions by a series of wet chemical and ion exchange procedures, and gravimetric and radiometric determinations performed. (auth)

6102 HASL-77

New York Operations Office, Health and Safety Lab., AEC. STRONTIUM PROGRAM. Quarterly Summary Report [for] September 1 through December 1, 1959. Edward P. Hardy, Jr. and Stanley Klein. Jan. 1, 1960. 232p. OTS.

Data are summarized on levels of strontium-90 in fallout, air, water, milk, vegetation, foods, and animal bones analyzed from September 1 to December 1, 1959. Data are included on levels of plutonium-239 and cesium-137 in human tissues and other biological materials. Data are summarized on fall-out levels in precipitation, soil, upper air, Mount Washington fog and cloud condensate, and Canadian milk samples. A bibliography is included which covers recent literature on fall-out and the strontium program. (C.H.)

6103 NP-8204

STATEMENT ON RADIOACTIVE FALLOUT OVER SCANDINAVIA MADE BY THE MEMBERS OF A SCANDINAVIAN CONFERENCE ON RADIATION PROTECTION, HELD IN OSLO, JUNE 4–5, 1959. 18p.

Data are presented on radioactive fall-out in the Scandinavian countries from 1950 to 1959. Measurements were made on levels of fission products in drinking water, food, and milk. A comparison is made between measured values and recommended values for maximum permissible concentration of the various radionuclides. Emphasis is placed on levels of strontium-90 and cesium-137. (C.H.)

6104 USNRDL-TR-220(Del.)

Naval Radiological Defense Lab., San Francisco. ANALYSIS OF FALLOUT DATA. PART I. THE JANGLE "S" AND "U" SHOT FALLOUT PATTERNS. C. F. Miller. Apr. 18, 1958. Decl. with deletions Sept. 29, 1959. 100p. OTS.

Fall-out data from Operations Jangle and Castle are analyzed and correlated by use of a graphical method to determine the loci of iso-ionization rate points in the fall-out area. The analysis was carried out to determine, from available data, the mass of fall-out associated with a given ionization-rate contour so that realistic compositions and amounts of materials could be estimated for reclamation investigations and to determine methods of data analysis and experimental design that could be used to improve the state of knowledge about the fall-out process. A graphical method is described for locating contours. Decay data from Operation Castle are analyzed, and decay corrections for the various kinds of measurements are derived. Decay corrections are applied to sample analysis data and ionization-rate data taken on a number of islands in the Pacific. Fall-out patterns for Castle Operation are constructed. (C.H.)

6105 WT-371(Del.)

Chemical and Radiological Labs., Army Chemical Center, Md.

PARTICLE STUDIES. Charles Robbins, Hugh R. Lehman, David R. Powers, and James D. Wilcox. July 1952. Decl. with deletions Sept. 15, 1959. 374p. Project 2.5a-1 [of] OPERATION JANGLE. OTS.

A study was made on data relative to the close-in ground level airborne and fall-out hazard associated with each detonation of Operation Jangle. Samples of the aerosol and fall-out were obtained from 46 stations located between 4,000 feet upwind and 50,000 feet downwind. The concentration of beta activity in the cloud near ground zero was also measured. Data were also obtained on the variation of activity with particle size. Data are tabulated. (C.H.)

6106 WT-396(Del. 2)

National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.

BIOLOGICAL INJURY FROM PARTICLE INHALATION. Falconer Smith, D. W. Boddy, and Marvin Goldman. June 18, 1952. Decl. with deletions Sept. 25, 1959. 55p. Project 2.7 [of] OPERATION JANGLE. OTS.

Mongrel dogs and sheep were exposed at 2500, 5000, and 8000 feet from surface and underground zero. The purpose of the exposure was to assess the hazard due to inhalation of the dust associated with surface and underground atomic detonations, and to compare the internal and external doses obtained in the exposed test animals. Animals were sacrificed at from H + 10 to H + 24 hours, and at D + 2, D + 4, D + 9, and D + 70 days. Dry ashed homogenates of lung, liver, spleen, kidney, blood, bone, urine, and gut contents were assayed for radioactivity. Representative pieces of soft tissues were fixed by a freezing dehydration method for the preparation of autoradiographs. Samples of bone were wet ashed and assayed for their radioactivity. Radioactivity in tissues taken from animals exposed during the surface shot was extremely low and total body amounts of radioactive materials found at the time of sacrifice were estimated to range between 0.06 and 2.13 μc. Total-body activity for animals exposed during the underground test ranged between 2.22 and 31.1 μc. Integrated internal dosage due to β emission ranged from 0.10 to 0.43 rep. Dosage for dog lungs due to β emission ranged between 0.25 and 7.03 rep and between 0.19 and 8.83 rep for sheep lungs. Tissue radioactivity had fallen below limits of detection in all animals by D + 9 following the underground shot. Embryonic tissues and associated fluids contained just detectable activity. Three types of radioactive particles were detected in autoradiographs of lung tissue. One of these particles was a pure α emitter of 5 mev energy and was probably Pu^{239}. A second type of active particle emitted α and β particles while a third was a pure β emitter of indeterminate energy. Autoradiographs of soft tissue other than lungs showed no blackening. A few bone samples contained sufficient activity to cause some blackening on Ilford plates after 29 days of exposure. No evidence of α activity

could be detected in bone samples. Radiochemical analysis of the femurs strongly indicated that their activity was due to Ba^{140} and Sr^{90}. Amounts of activity taken up by the combined action of inhalation and ingestion in animals exposed to the dust associated with either type of detonation were not physiologically significant. The mixture of materials thus taken up was undetectable in tissues of animals sacrificed 4 days after the surface shot and 9 days after the underground shot. It is calculated that the underground detonation of a 20 KT weapon would not result in a short term inhalation and ingestion hazard to dogs and sheep exposed under conditions comparable with those prevailing during the JANGLE underground test. (auth)

6107 WT-718(Del.)

Signal Corps Engineering Labs., Fort Monmouth, N. J. GAMMA RADIATION SPECTRUM OF RESIDUAL CONTAMINATION. Robert C. Bass, Lowell J. Smith, and Stanley H. Ungar. May 1955. Decl. with deletions Sept. 15, 1959. 68p. Project 2.2a [of] OPERATION UPSHOT-KNOTHOLE. OTS.

The gamma spectral distribution of the residual contamination resulting from tower and air detonations was determined. While data were obtained utilizing two types of instrumentation, primary emphasis was placed on the use of a scintillation spectrometer. The measurements consisted of a determination of the spectral distribution of the secondary electrons produced by the incident photons in two different scintillating phosphors. The secondary method utilized five radiac instruments, one of which was air equivalent. The other four were modified by lining the lucite walls of the ionization chambers respectively with aluminum, copper, tin, and lead. Measurements were made at times varying from 1 hour to 10 days following detonation, at positions near ground zero for air bursts and at ranges from 1000 yards to 3 miles from ground zero for tower shots. The locations at which readings were taken were limited inasmuch as the techniques used were reliable only at gamma ray intensities of less than 500 mr/hr. An analysis of the data obtained during Operation UPSHOT-KNOTHOLE indicated that the major contribution to the gamma radiation associated with the residual contamination is from gamma rays of energy greater than 200 kev and that little radiation lies above 2 Mev in energy. The results of the two types of instrumentation used are in good agreement both as to spectral quality and approximate spectral extent and results obtained with the lined chambers appear to be in agreement with those obtained during Operation SNAPPER. Results obtained from the scintillation spectrometer measurements are presented in the form of plots of gamma photon flux and gamma radiation intensity in mr/hr as a function of energy between 40 kev and 3 Mev at different times after detonation for various locations in the residual contamination field. Results obtained from the lined ionization chambers and comparison of these results with those of the scintillation spectrometer measurements are presented in tabular form. (auth)

6108 WT-939(Del.)

Naval Radiological Defense Lab., San Francisco. PHYSICAL FACTORS AND DOSIMETRY IN THE MARSHALL ISLAND RADIATION EXPOSURES. C. A. Sondhaus and V. P. Bond. Dec. 1955. Decl. with deletions Sept. 15, 1959. 26p. Addendum Report for Project 4.1 [of] OPERATION CASTLE. OTS.

The physical factors and dosimetry of the fall-out on the Marshall Islands from the first shot of Operation CASTLE are considered. Data were summarized from field Radiological Safety surveys, fall-out radiochemical studies, and fall-out gamma spectral measurements. The influence of these and other factors on an evaluation of survey meter response and total dose estimates was considered. Estimates of fall-out duration times and energy distribution of the dose from a plane source were made and the effect of diffuse source-geometry on the depth-dose to air-dose relationship was considered. Superficial doses from soft gamma and beta radiation were also considered. Since the fall-out incident created an initial emergency during which data collection was of secondary importance, attempts to reconstruct the event have been uncertain. However, a fairly consistent estimate of external gamma dosage was possible, although the question of beta exposure remains mostly unanswered. It was assumed that no significant neutron or alpha particle exposure occurred. Internal doses from inhaled or ingested material and the biomedical aspects of the incident have been discussed in other CASTLE reports. It was concluded that the AN/PDR-39A requires a correction factor of about plus 20% in dose-rate readings made under the conditions described; decay of the radioactivity of the fall-out is believed expressible by the factor of $T^{-0.83}$; the external gamma dose was delivered primarily by radiation energies of 100, 700, and 1500 kev; the beta dose was delivered by beta radiation of maximum energies of 0.3 and 1.8 Mev, mostly from fall-out deposited on the skin itself; the exposures occurred between 4 and 78 hours after the detonation, the fall-outs were probably of 12-hours duration; diffuse source geometry increased the midline dose by about 50% compared to the midline dose which would have resulted from a bilateral narrow beam exposure of the same air-dose; error in the estimates is believed to be less than 50%; and total air gamma doses were estimated as follows: Rongerik, 86 r; Rongelap, 182 r; Ailinginae, 81 r; and Utirik, 13 r. (auth)

6109

FALLOUT FROM NUCLEAR WEAPONS TESTS. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON FALLOUT FROM NUCLEAR WEAPONS TESTS, MAY 5, 6, 7, AND 8, 1959. VOLUME 1. Washington, D. C., Joint Committee on Atomic Energy, 1959. 953p. (GPO)

Public hearings were held May 5 to 8, 1959, on fall-out from nuclear weapons tests. Volume 1 reviews developments since the 1957 hearings and presents new data on atmospheric and global fall-out levels. It was stated that the program of fall-out sampling and monitoring supported by the AEC is quite comprehensive and during 1959 approximately $2.6 million was spent on a program of scientific research with the purpose of understanding the factors that influence the patterns and rates of fall-out onto the earth's surface. This has meant sampling longitudinally, latitudinally, and vertically. A training program for scientists to carry out this program was maintained. Experimental and laboratory work centered on the movement of fall-out into the food chain and water supplies and the effects of ionizing radiation on the human body and on human germ cells. Separate abstracts have been prepared on a number of statements which summarize the results of recent research on fallout. (C.H.)

6110

NATIONAL WATER QUALITY CONTROL NETWORK. p. 167-9 of "Fallout From Nuclear Weapons Tests, Vol. 1."

In 1956 a federal-state-local cooperative program was

inaugurated to collect and disseminate basic data on water pollution and its prevention. Approximately 50 sampling locations were authorized for the initial phase of this program. Samples for radioactivity, coliform organisms, and the conventional analyses were collected and analyzed weekly. Samples for organic chemicals, plankton organisms, and radioactivity were collected and examined monthly. Data are tabulated on dissolved beta activity in each of the major river basins. (C.H.)

6111

RADIOACTIVITY MEASUREMENTS; NATIONAL AIR SAMPLING NETWORK OF THE PUBLIC HEALTH SERVICE. p. 170-85 of "Fallout From Nuclear Weapons Tests, Vol. 1."

The National Air Sampling Network of the Public Health Service was developed to secure basic data on the nature and extent of air pollution throughout the nation and to detect trends in levels of pollution with respect to time, location, population density, climate, and other factors associated with air quality. Data are tabulated on beta radioactivity in air samples collected from 1953 to 1958. (C.H.)

6112

THE OCCURRENCE OF STRONTIUM-90, IODINE-131, AND OTHER RADIONUCLIDES IN MILK—MAY 1957 THROUGH APRIL 1958. J. E. Campbell, G. K. Murthy, A. S. Goldin, C. P. Straub, and K. H. Lewis (Robert A. Taft Sanitary Engineering Center, Cincinnati); H. B. Robinson (Div. of Sanitary Engineering Services, Washington, D. C.); and F. J. Weber (Div. of Radiological Health, Washington, D. C.). p. 186-96 of "Fallout From Nuclear Weapons Tests, Vol. 1."

Findings are summarized from a survey of specific radionuclide activity in milk samples from five areas of the United States. These areas are located in the milksheds serving Sacramento, Salt Lake City, St. Louis, Cincinnati, and New York City. Sampling procedures and a simplified method of radiochemical analysis for milk are described. Data are tabulated on the concentrations of iodine-131, cesium-137, strontium-89, strontium-90, barium-140, and calcium in milk samples collected in 1957 and 1958. (C.H.)

6113

REPORT ON RADIOACTIVITY IN MILK (1957–1959). (Public Health Service, Washington, D. C.). p. 197-256 of "Fallout From Nuclear Weapons Tests, Vol. 1."

Data are tabulated on the radioactivity in milk collected at 10 sampling stations across the country during January 1959. Data are included on levels of iodine-131, strontium-89, strontium-90, barium-140, cesium-137, and calcium in milk samples. Results are compared with 12-month averages. (C.H.)

6114

STRONTIUM 90 DISTRIBUTION AS DETERMINED BY THE ANALYSIS OF SOILS. Lyle T. Alexander (U. S. Dept. of Agriculture, Beltsville, Md.). p. 278-371 of "Fallout From Nuclear Weapons Tests, Vol. 1."

Most strontium-90 reaches the surface of the earth in the water brought down from the air by rain and snow. Most soils retain strontium-90 against leaching by rain water in the same way that they retain the plant nutrient element calcium. There is a gradual movement of the element downward in proportion to the amount of water passing through the soil into the ground water. The process is very slow and even in areas of high rainfall it takes several years to move strontium-90 downward a few inches. Because of this retention, properly selected soils can give a good integrated value of the strontium-90 that has fallen to the ground in a selected location. A worldwide soil sampling program has been carried out to determine how much strontium-90 has reached the surface of the earth in the various latitudes and rainfall belts. Sampling and analytical procedures are discussed. Data are tabulated on the strontium-90 values for samples collected during 1958. Data are included on the total precipitation in each region from 1953 through 1958. (C.H.)

6115

DATA ON THE DEPOSITION OF STRONTIUM-90 DURING 1958. John H. Harley, Edward P. Hardy, Jr., Stanley Klein, and S. Allan Lough (U. S. Atomic Energy Commission, New York). p. 373-482 of "Fallout From Nuclear Weapons Tests, Vol. 1."

The deposition of strontium-90 may be measured by the rate of fall-out or by the cumulative deposition based on soil analysis. The two methods are considered supplementary. Monthly collections of fall-out have been made over a period of several years using stainless steel pots. An improved device consisting of a plastic funnel and ion exchange column was developed recently for use with the stainless steel pots. During the 1958 summer weapons tests in the Pacific, tungsten-185 with a half-life of 74 days was produced. This nuclide furnished a tracer for this particular test series. A list of world-wide soil and pot collection stations is included. Monthly fall-out data for all of 1958 and parts of 1957 and 1959 are presented. Data are tabulated on the strontium-90, strontium-89, and tungsten-185 content of the samples and the precipitation at each collection site during the sampling period. An analysis of the data is included. (C.H.)

6116

CURRENT INFORMATION ON THE RADIOACTIVITY OF THE AIR. Luther B. Lockhart (U. S. Naval Research Lab., Washington, D. C.). p. 483-511 of "Fallout From Nuclear Weapons Tests, Vol. 1."

The U. S. Naval Research Laboratory program of atmospheric radioactivity studies consists of a program of daily measurements of the natural radioactive materials supplemented by measurements of gross fission products in the air at a number of sites, principally in the Western Hemisphere. The Laboratory also participates in the operation of a unified network of stations along the 80th meridian (west) which collect daily samples of the radioactivity in the air for radiochemical analysis. No measurements of fall-out as such are made in this program but only measurements of the concentrations of radioactive matter in the air. The determination of the background radioactivity due to decay products of radon and thoron in the air gives one baseline for evaluating the relative hazard associated with the addition into man's environment of new radioactive matter due to fission products. Data collected by the stations, which have operated continuously for the past ten years, furnish a record of the progressive changes in fission product concentration in the atmosphere with time. Air monitoring and air sampling equipment employed in the two programs are described. Data are tabulated and analyzed. The fission product radioactivity of the air increased markedly in the Northern Hemisphere during 1958 and the first part of 1959. Radioactive debris injected into the troposphere at any particular site was observed to spread rapidly throughout the entire hemisphere but rarely across the equator in any quantity. Radioactive techniques proved

satisfactory for determining the source and age of radioactive debris. When a unique tracer material, for example tungsten-185, was present in debris from a single source or injection site, it was found to be an excellent means of identifying material from this source in the presence of a high background of radioactive products from other sources. In spite of the large increase in the radioactivity of nuclear debris in the air, this material contributed only a small fraction of the total radioactivity of the ground-level air. (C.H.)

6117

PROGRAM OF MEASUREMENT OF THE RADIOACTIVITY OF THE AIR ALONG THE 80TH MERIDIAN. L. B. Lockhart, Jr., R. A. Baus, and I. H. Blifford, Jr. (U. S. Naval Research Lab., Washington, D. C.). p. 512-18 of "Fallout From Nuclear Weapons Tests, Vol. 1."

The program for the measurement of radioactivity of the air along the 80th meridian is outlined. Equipment and collecting procedures are described. Data are tabulated on fission product β activity of samples collected by air filtration during July 1957. The samples were analyzed for natural sources of radioactivity and certain fission products. (C.H.)

6118

FISSION PRODUCT RADIOACTIVITY IN THE AIR ALONG THE 80TH MERIDIAN—JANUARY–JUNE 1957. L. B. Lockhart, Jr., R. A. Baus, and I. H. Blifford, Jr. (U. S. Naval Research Lab., Washington, D. C.). p. 519-27 of "Fallout From Nuclear Weapons Tests, Vol. 1."

A comparison is presented of three collecting methods employed for the measurement of fission product radioactivity in the air along the 80th meridian (west). Gummed-film and cloth-screen collectors were discarded in favor of air filters employing a positive displacement pump with a free-air capacity of about 40 cfm and an efficient filter paper. Samples of atmospheric radioactivity were collected at the various collecting sites and forwarded to the U. S. Naval Research Laboratory, Washington, D. C., via air mail. The samples were then ashed and measured for gross β activity. Results are tabulated for samples collected between January and June 1957. The effects of rainfall and nuclear explosions during the period on radioactivity of the air are discussed. (C.H.)

6119

SOME MEASUREMENTS OF THE RADIOACTIVITY OF THE AIR DURING 1957. L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, and I. H. Blifford, Jr. (to U. S. Naval Research Lab., Washington, D. C.). p. 528-60 of "Fallout From Nuclear Weapons Tests, Vol. 1."

Results are reported from measurements of the radioactivity of the air during 1957. The contributions of natural and fission product components to the radioactivity of the air are discussed. The relative importance of the various radioactive components in terms of their contribution to the total radioactivity of the air is outlined. Collection, radiochemical analysis, and counting procedures are described briefly. Radon, thoron, and gross fission product concentrations in the air were calculated from data collected during 1957. The concentration of radioactive materials in the air at any given site was observed to vary widely from day to day due to the various local meteorological factors involved. In addition to short-term processes, seasonal factors involving atmospheric inversions were observed to affect the levels of radon and thoron and it is assumed they will also affect the long-term fall-out of old fission debris from the stratosphere. Fission product levels in the lower atmosphere were found to be more strongly influenced by the occurrence of nuclear tests in the geographical area. Data are tabulated on the daily atmospheric radioactivity in filter samples collected during 1957. (C.H.)

6120

FILTERING EFFICIENCY OF IPC FILTER PAPER FOR PARTICULATE NUCLEAR DEBRIS AT LOW AIR FLOW RATE. p. 673-93 of "Fallout From Nuclear Weapons Tests, Vol. 1."

Results are summarized from a laboratory and field test evaluation of the collection efficiency of I.P.C. (Institute of Paper Chemistry) filter mats for radioactive particulates resident in the stratosphere. Sampling operations consisted of balloon-borne particulate filter sampling at 40,000 feet and two jet aircraft equipped with type F-33 filtering foils on each wing tip. Sampling was conducted only when the tropopause was below the 40,000 foot operational altitude limit for the jet aircraft. The primary objective was to determine the collection efficiency of IPC filter paper at a linear ambient air flow rate through the paper of about 80 feet per minute for the physical particles of castle debris containing strontium-90. Other objectives were to test the efficiency of this filter for fresh nuclear debris at about 2,000 and 3,500 feet per minute linear ambient flow rate. Data are tabulated. (C.H.)

6121

THE COLLECTION EFFICIENCY OF I.P.C. FILTER MATS FOR RADIOACTIVE PARTICULATES IN THE STRATOSPHERE. S. C. Stern (General Mills, Inc., Minneapolis). p. 694-709 of "Fallout From Nuclear Weapons Tests, Vol. 1."

An investigation of stratospheric radioactivity was made by launching into the stratosphere and recovering nine balloons carrying aerosol sampling devices. The major components of the aerosol sampling device consisted of a fibrous filter mat, fabricated by the Institute of Paper Chemistry, and a large-volume air mover. These components were housed in a cylindrical container with a hinged cover. The sampling units became known as "ash cans." A photograph and schematic sketch of the particulate sampling device are included. Experimental flights were made during April and May 1956 to demonstrate that airborne radioactive debris in the stratosphere could be sampled in sufficient quantity for accurate radiochemical assays. Data are tabulated and results are discussed. (C.H.)

6122

PROJECT ASH CAN PARTICULATE RADIOACTIVITY DATA. p. 710-39 of "Fallout From Nuclear Weapons Tests, Vol. 1."

A network of stations was established in the Western Hemisphere to periodically launch and recover balloon-borne stratospheric particulate sampling units of the ash can type. The filters contained in the sampling device were analyzed by radiochemical methods for total activity and the presence of strontium-89, strontium-90, zirconium-95, cerium-144, cesium-137, and barium-140. Data collected from November 1956 through April 1959 are tabulated. The ratio of strontium-89 to zirconium-90 and of cesium-137 to zirconium-90 was calculated. (C.H.)

6123

[FALLOUT MODEL]. Lester Machta (U. S. Weather Bureau, Washington, D. C.). p. 778-806 of "Fallout From Nuclear Weapons Tests, Vol. 1."

The contribution of injections at polar latitudes to stratospheric radioactive fall-out levels is discussed. Mechanisms involved in the transport of stratospheric fall-out and the length of storage time are considered. Data from the analysis of samples of soil and rain water collected throughout the world during 1958 are reviewed. The stratospheric residence time for fall-out debris was calculated to be between 4 and 5 years for equatorial injections and about one year for polar stratospheric injections. The theory of turbulence in the overlapping areas of the troposphere and the contribution of this condition to stratospheric storage of fall-out debris are discussed. Graphical data are included on the latitudinal distribution of strontium-90 in soil samples collected throughout the world from 1956 through 1958; the mean fission products in samples of surface air collected at 80° West Longitude following Hardtack Operation in the Spring of 1958; the mean fission products in surface air at 80° West Longitude following the Russian series of tests in October 1958 at 73° N Latitude; stratospheric levels of strontium-90 from November 1956 to December 1958; fall-out levels in the spring of 1959 due to the Russian October series; rainfall during the spring of 1959 and the ratio of strontium-89 to strontium-90 in samples of rain water; a summary of data on total fall-out following the Russian October series; predicted levels of soil activity up to 1978; and levels of atmospheric carbon-14 produced during nuclear explosions. (C.H.)

6124

GLOBAL FALLOUT AND ITS VARIABILITY. E. A. Martell (Air Force Cambridge Research Center, Mass.). p. 810-40 of "Fallout From Nuclear Weapons Tests, Vol. 1."

It is pointed out that the reliable interpretation of world-wide fall-out has been severely limited by a lack of understanding of large-scale atmospheric circulation and mixing processes. The pace and variety of atomic testing have also confused the interpretation of fall-out evidence. Evidence for substantial variation in stratospheric storage times, tropopause transport paths, and final surface distribution areas for various high yield atomic tests is presented and discussed. Data are tabulated on the approximate stratospheric contamination from major weapons tests from 1952 through 1958. Data on rainfall and activity in samples of rain water and soil collected at a number of locations are reviewed. (C.H.)

Radiation Effects on Living Tissues

6125 AF-SAM-60-10

Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Brooks AFB, Tex.

AN ANALYSIS OF THE $LD_{50/30}$ AS RELATED TO RADIATION INTENSITY. Loren C. Logie, Milford D. Harris, Robert E. Tatsch, and Eugene N. Van Hooser. July 15, 1959. 6p.

A mathematical analysis was made of the $LD_{50/30}$ as related to gamma radiation dose intensity in rats. An inverse relationship was found between radiation intensity and a biologic end point which is similar to that found by other investigators using other species and other experimental end points. Three equations relating effective dose to the radiation time and intensity were formulated. These equations are an expression of an over-all biologic response and limit the worth of the effective dose equations to the period of exposure. Their applicability as a first approximation may be possible for a brief postirradiation period if it is assumed that there is no precipitous change in the recovery rate immediately following the end of the exposure. (C.H.)

6126 NP-8254

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

THE EFFECT OF IONIZING RADIATION ON THE δ-AMINOLAEVULIC ACID DEHYDRASE IN RATS. Report No. 47/XRB. A. M. Dancewicz, B. Lipiński, and O. Rosiek. Dec. 1958. 16p.

The activity of δ-aminolaevulic acid dehydrase (ALAD) was studied in liver, kidney, spleen, and bone marrow homogenates of rats exposed to a single whole-body x irradiation with doses 25 to 1000 r. Determinations were made at different intervals of time after exposure (from several hours to 60 days). With doses of below 100 r ALAD activity increased during the first few days after exposure. With medium doses (400 r) ALAD activity decreased and then increased again in the regeneration phase of the radiation disease. With the doses of 650 and 1000 r ALAD activity rapidly dropped in these organs and remained on this level until the animal's death. ALAD activity in kidney and liver under the same conditions of irradiation underwent no essential changes. Only a slight decrease was observed. (auth)

6127 NP-8295

Vanderbilt Univ., Nashville. School of Medicine.

LONG-TERM DOG FEEDING EXPERIMENT ON IRRADIATED CHICKEN, BEEF AND JAM. Progress Report No. 5-A [for] March 1, 1959 to September 1, 1959. Frank R. Blood, William J. Darby, Richard Dybdahl, Carl E. Miller, Charles W. Scheffer, Jon M. Buhler, George Francis, Matthew S. Wright, Robert G. Horn, and Jerry N. Clanton. 27p. Contract DA-49-007-MD-779.

Data are tabulated on the physical condition of dogs maintained for 84 weeks on a diet containing 35% of solids of irradiated boned chicken, ground beef, and pineapple jam. (C.H.)

6128 NP-8296

Vanderbilt Univ., Nashville. School of Medicine.

LONG-TERM MONKEY FEEDING EXPERIMENT ON IRRADIATED PEACHES, WHOLE ORANGES AND PEELED ORANGES. Progress Report No. 5-B [for] March 30, 1959 to September 13, 1959. Frank R. Blood, William J. Darby, Richard Dybdahl, Carl E. Miller, Charles W. Scheffer, Jon M. Buhler, George Francis, Matthew S. Wright, Robert G. Horn, and Jerry N. Clanton. 26p. Contract DA-49-007-MD-779.

Data are summarized on the physical condition of monkeys maintained for 84 weeks on a diet containing irradiated peaches, whole oranges, or peeled oranges. (C.H.)

6129 NP-8297

Vanderbilt Univ., Nashville. School of Medicine.

LONG-TERM RAT FEEDING EXPERIMENT ON IRRADIATED BEEF. Progress Report No. 4C [for] March 31, 1959 to September 30, 1959. Frank R. Blood, William J. Darby, Richard C. Dybdahl, Carl E. Miller, Jon M. Buhler, George Francis, Charles W. Scheffer, Matthew S. Wright, Jerry N. Clanton, and Robert G. Horn. 27p. Contract DA-49-007-MD-779.

6130 USNRDL-TR-372

Naval Radiological Defense Lab., San Francisco.

MODIFICATION OF BSP METABOLISM BY BILE STASIS AND LIVER INJURY. J. S. Krebs and R. W. Brauer. Oct. 9, 1959. 22p.

Excretion of sulfobromophthalein sodium (BSP) into bile by the liver of the rat was prevented or reduced by temporary bile stasis, carbon tetrachloride intoxication, or whole-body x-ray exposure. BSP was injected, bile was collected for a standard period of time, and the BSP excreted into bile was analyzed for distribution among its metabolic products. An increase was found in the compound representing the apparent terminus of the metabolic sequence, indicating that metabolism of BSP had continued during the delay in excretion. The results suggest that an immediate consequence of bile stasis is an arrest of the net secretion of BSP, whether fluid continues to be secreted or not. The possible relationship of the effects of the delay in excretion of BSP to the apparent concentration of BSP in plasma is pointed out. (auth)

6131

INTRODUCTION TO SYMPOSIUM ON THEORETICAL RADIOBIOLOGY. Henry Quastler (Brookhaven National Lab., Upton, N. Y.). Am. Naturalist 94, 57-8(1960) Jan.-Feb.

A Symposium on Theoretical Radiobiology was held at Pittsburgh, Penna., May 20, 1959. Separate abstracts have been prepared on the five papers presented. (C.H.)

6132

RADIATION INACTIVATION OF MOLECULES IN CELLS. Franklin Hutchinson (Yale Univ., New Haven). Am. Naturalist 94, 59-70(1960) Jan.-Feb.

The mechanisms by which molecules in cells are inactivated by ionizing radiations are discussed. Experiments on the inactivation of enzymes and of desoxyribosenucleic acid in dry cells are in good agreement with the hypothesis that direct action requires an ionization either within the molecule, or very close to it. When wet cells are irradiated, the increased radiosensitivity can be explained quantitatively by assuming an indirect effect caused by the diffusion of radiation-produced radicals which diffuse a distance the order of magnitude of 30 angstroms. These mechanisms explain the experimental fact that biological macromolecules in cells are very resistant to radiation, and require doses the order of megarads, or greater, to inactivate half of the molecules of a given kind. They also imply that the initial biochemical effects are produced very close to the sites of the ionizations, providing a justification for the use of target theory. It thus appears that if the inactivation of a living cell is to be ascribed to the inactivation of molecules, then a number the order of a thousand molecules must be assumed, each indispensable for the process of cell division, to account for the observed effective doses. (auth)

6133

THEORETICAL ASPECTS OF THE EFFECT OF IONIZING RADIATION ON THE BACTERIAL CELL. Ernest Pollard (Yale Univ., New Haven). Am. Naturalist 94, 71-84(1960) Jan.-Feb.

A series of equations for cellular synthesis in bacteria based on the steady formation of DNA, followed by successive formation of RNA, ribosomes, protein, and lipid are developed. Using the observation that radiation inhibits the formation of ribosomes, the simplified equations are solved. The linear uptake of SO_4 and PO_4 is explained and a suggestion for the formation of long filaments, or giant cells is made. The equations contain the possibility that a delayed budding-off of a new cell can occur. The hypothesis is presented that the disruption of a part of the nucleus, namely the organized set of enzymes which "make" RNA, is responsible for the action. Consideration is given to enzyme formation, which can conceivably increase, and, in particular, it is predicted that RNA-ase should increase after irradiation. The uptake of amino acids, the process of respiration, and of adaptive enzyme formation are discussed. (auth)

6134

RADIATION STUDIES ON THE NATURE OF CHROMOSOME BREAKAGE. Sheldon Wolff (Oak Ridge National Lab., Tenn.). Amer. Naturalist 94, 85-93(1960) Jan.-Feb.

We have been able to study separately the phenomena of chromosome breakage and rejoining, phenomena that are involved in the production of intergenic mutations. It seems as though protein synthesis is necessary for the rejoining to occur and so far our results are not inconsistent with the interpretation that the actual bonds formed are protein links. We do know that RNA and DNA synthesis do not seem to be involved. However, it still might be that the protein synthesis is only making enzymes that are necessary for the repair of these breaks and that we have not as yet characterized the bond formed. It has also been established that cellular metabolism is important in the genetic damage repair that is manifested as rejoining of breaks. It has been found that a similar postirradiation treatment can decrease, in other organisms, genetic damage that may be point mutations. (auth)

6135

THE ACTION OF RADIATION ON MAMMALIAN CELLS. T. T. Puck (Univ. of Colorado Medical Center, Denver). Am. Naturalist 94, 95-109(1960) Jan.-Feb.

The action of x irradiation on mammalian cells has been studied under carefully controlled conditions in vitro, by means of single cell survival curves, and through direct visualization of the chromosomes after varying doses of radiation. Mammalian cells generally are exceedingly sensitive to destruction of their ability to reproduce, the mean lethal dose, D^0, for various animal cells varying between 50 and 150r. The normal, diploid human cell exhibits a D^0 of 50r, while that for aneuploid hyperploid human cells is about 100r. A variety of independent kinds of evidence establish that the primary radiobiologic action responsible for reproductive death of human cells in these dose ranges is damage to the genetic apparatus, and primarily to the chromosomes. Experiments demonstrate that a dose as little as 20 to 40 r is sufficient to introduce an average of one chromosome break per cell in normal diploid human cells in vitro. These breaks restitute normally if there is only one per cell, and soon leave no visible evidence of their presence. If many breaks are introduced in each cell, abnormal recombinations such as dicentric chromosomes and other aberrations are formed. Analysis of the survival curves demonstrates that some cells, like the normal diploid human cell, are killed reproductively to a significant extent by single-hit events, but that hyperploid aneuploid cells require multiple hits, which produce complex chromosomal forms. The effects of ultraviolet radiation, which produces gene mutations but relatively few chromosome breaks, are readily explainable by these considerations. By means of the concept of chromosome breakage and the attending destruction of cell-reproductive function, it is possible to understand both qualitatively and quantitatively many of the features of the acute whole body radiation syndrome in mammals. (auth)

6136

CELLULAR RADIATION EFFECTS. Maurice Errera (Laboratoire de Morphologie Animale, Faculté des Sciences, Brussels). Am. Naturalist 94, 111-28(1960) Jan.-Feb.

A critical review is given of radiation effects on cytological structures: mitochondria, lysosomes, microsomes, cytoplasmic soluble components, cell membranes, and nucleus. The implications of these changes for the analysis of radiation effects upon biological functions are discussed. The functions studied are cell growth, cell division, movements and differentiation. (auth)

6137

CONTRIBUTION TO THE STUDY OF THE HEMATOPOIETIC REGENERATION AFTER IRRADIATION BY X RAYS. I. REGENERATION OF SPLEEN GRAFTS IRRADIATED IN VIVO AND IN VITRO. G. Booz (Université, Liége). Ann. anat. pathol. 4, 587-616(1959) July-Sept. (In French)

As an introduction to a study of hematopoietic regeneration, the effects of x radiation on hematopoietic tissues, hematopoiesis and radiation resistance, and the factors affecting hematopoietic regeneration are discussed, and the results of previous studies are reviewed. The hematopoietic regeneration of splenic tissue of normal mice grafted to a young homozygote animal is first studied. After demonstrating the possibility of such a regeneration, the regenerating capacities of spleen grafts from animals irradiated in toto at increasing doses of x radiation are then investigated. The results showed that only after an irradiation of 10,000 r is a delay in the process of regeneration noticed. The spleens were irradiated in vitro, and the regeneration capacity when grafted to normal mice was determined. An exposure of 10,000 r was necessary to obtain a definite effect on the regeneration. (J.S.R.)

6138

DANGERS OF RADIATION AND HOW TO PROTECT. G. Wagner (Service federal de l'hygiene publique, [Ger.]). Atomenergie 3, No. 3-4, 43-51(1959) Nov. (In French)

A discussion is presented of the effects of various exposures to the different types of radiation on living material. Somatic and genetic lesions, effects on skin, therapy, genetic effects, and prophylaxis are considered. (T.R.H.)

6139

EPIDEMIOLOGICAL STUDIES OF LEUKEMIA IN PERSONS EXPOSED TO IONIZING RADIATION. L. H. Hempelmann (Univ. of Rochester, N. Y.). Cancer Research 20, 18-27(1960) Jan.

After reviewing the epidemiological studies of persons exposed to ionizing radiation, it is concluded that there is no doubt that radiation exposure in man is associated with an increased incidence of leukemia and that a cause-and-effect relationship must be accepted. Such an association holds in the higher dose range regardless of sex and age, the amount of body exposed, and whether or not the radiation was administered as a single dose or intermittently over a long period of time. A proportionality was found to exist between leukemia incidence and dosage in the middle dose range. This relationship was not observed in children treated for thymic enlargement in infancy. Although it has previously been suggested that children are more sensitive to the leukemogenic effects of radiation than adults, it is concluded that the present retrospective studies of prenatal exposure of children dying of leukemia or cancer do not establish exposure to diagnostic doses of radiation as an etiologic factor. (auth)

6140

NUCLEIC ACID METABOLISM IN REGENERATING RAT LIVER. VII. EFFECT OF X-RADIATION ON ENZYMES OF DNA SYNTHESIS. F. J. Bollum, J. W. Anderegg, Anne B. McElya, and Van R. Potter (Univ. of Wisconsin, Madison). Cancer Research 20, 138-43(1960) Jan.

The effect of x-radiation on the appearance of thymidine kinase and deoxyribonucleic acid (DNA) polymerase in regenerating rat liver was studied as a function of dose (375,750, and 1500 r) and time of administration of radiation (6 or 16 hours) relative to the time of partial hepatectomy. When the radiation was given 6 hours after operation, all levels of radiation produced essentially complete inhibition of the increase in enzyme levels that would be expected to occur between 6 and 24 hours after partial hepatectomy. When the radiation was given 16 hours after operation, a time previously shown to completely block DNA synthesis in regenerating liver in vivo, the usual increase between 16 and 24 hours was not prevented. The results are discussed in relation to data obtained on whole animals, and it is suggested that inhibition observed in in vivo studies with radiation given 16 hours after operation must be explained in terms other than the inhibition of thymidine kinase or DNA polymerase or their formation, while radiation given 6 hours after operation may act by preventing the formation of the appropriate enzyme-forming systems. (auth)

6141

THE EFFECTS OF X-RAYS ON THE MECHANISMS CONTROLLING THE LEVEL OF FREE HISTAMINE IN TISSUES. E. I. Krichevskaya (Krichevskaia) and G. V. Kapitonova (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 435-8(1959) Nov. 11. (In Russian)

An analysis was made of skin, kidney, and brain tissues from white mice following exposure to a single lethal x-ray dose (800 to 1000 r) in order to determine the role played by histidinedicarboxylase-histaminase fermenting system in free histamine changes in irradiated animals. Studies were also made of x-ray effects on free and general histamine in animals. (R.V.J.)

6142

STUDIES ON NUCLEI. II. EFFECTS OF X-RAYS ON DEOXYRIBONUCLEOPROTEIN FROM RAT THYMUS. W. D. Fisher, N. G. Anderson, and K. M. Wilbur (Oak Ridge National Lab., Tenn. and Duke Univ., Durham, N. C.). Exptl. Cell Research 18, 481-93(1959) Nov.

One molar NaCl extracts of rat thymus are highly sensitive to x rays, and an exposure of 10 r causes a detectable loss in viscosity. An after effect was observed, and the viscosity of irradiated samples continued to decrease for 4 to 5 hours after irradiation. Dose curves were sigmoid. The effect of x rays on the extracts were largely indirect. Freezing, the addition of chemical protective agents, and increasing the concentration of the gell all had a dose-reducing effect. There seemed to be a small contribution from direct effects not exceeding a few per cent of the total. Except for cyanide, all of the compounds tested that are known to protect animals from the lethal effects of irradiation also protected in the extracts. However, several compounds that had no protective action on animals gave large dose-reduction factors in the extracts. No good correlation exists between chemical agents protecting animals and those giving dose-reducing effects in the extracts. The high sensitivity of the extracts to x irradiation appeared to be a direct consequence of the high dilutions employed. Direct irradiation of the homogenate and excised tissue required, respectively, 100 and 700 times the x-ray dose necessary to produce the same effect in the extracts. The higher doses probably reflect protection from indirect ef-

fects by the high concentration of DNP in the cell nucleus and by protective substances such as proteins. The fact that one can demonstrate an effect by direct irradiation of the tissue is of interest, since no effects on DNA have been detected after irradiation in vivo. (auth)

6143

CYTOLOGICAL CONSEQUENCES OF CHROMOSOME BRIDGES IN X-IRRADIATED L STRAIN MOUSE CELLS. J. F. Whitfield, R. H. Rixon, and P. O. W. Rhynas (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Exptl. Cell Research 18, 591-3(1959) Nov.

Observations are reported on a post-irradiation accumulation of large numbers of cell pairs in suspension cultures of mouse cells in which the nuclei were connected by long strands of chromosome material. The connecting strands were attributed to the persistence of a number of anaphase chromosome bridges into the telophase stage and beyond. A nuclear membrane was observed to regenerate and enclose both telophase nuclei as well as the bridging chromosomes. Reaction mechanisms involved are discussed. (C.H.)

6144

ON THE MECHANISM OF RADIATION CARCINOGENESIS. Waro Nakahara and Fumiko Fukuoka (Japanese Foundation for Cancer Research, Tokyo). Gann 50, 17-21(1959) Mar.

Repeated subcutaneous injections in mice of hydrogen peroxide or free radicals generated from it by ferrous salt failed to produce carcinogenic effect. These negative results are interpreted as showing that the well known carcinogenic effect of ionizing radiation may be due, not to the chemical products, but rather to the energy released by the dissociation of water molecules, and/or to the direct action of radiation energy itself. These facts and deductions are consistent with our hypothesis that the proximate mechanism of experimental carcinogenesis may consist of the extra energy released intracellularly, whereby misconstruction or mutational changes, can be assumed to take place through disturbance of normal replication processes. (auth)

6145

THE TASKS OF THE EXPERIMENTAL TECHNIQUE OF RADIATION EFFECTS AND CERTAIN RADIOBIOLOGICAL DATA. M. P. Domshlak, N. G. Darenskaya, L. B. Koznova, and V. G. Khrushchev (Khruschev). Med. Radiol. 4, No. 12, 3-11(1959) Dec. (In Russian)

The various physical and biological factors which should be considered when assessing the results of radiobiological experiments are discussed. The importance of spatial radiation distribution in the effect of the injurious action is discussed. Data are presented on the relative biological effectiveness of x-ray and Co^{60} gamma-radiation. The significance of the "time factor" during the radiation effect in a wide range of doses for cases of local and total irradiation is demonstrated. Data illustrating the importance of individual sensitivity for the comprehension of the effect of radiation are given. The influence of sex, body weight, and the season on the final effect of irradiation is emphasized. An interpretation of the dose curve of the injurious action of radiation is given and the possible influences of physical and biological factors in respect to different dose levels discussed. (auth)

6146

CHANGES IN THE HIGHER NERVOUS ACTIVITY OF RATS DURING X-RAY IRRADIATION. I. S. Belokonski (Belokonsky). Med. Radiol. 4, No. 12, 11-16(1959) Dec. (In Russian)

Studies were made of changes in the higher nervous activity of rats protected with chemical substances and of those not protected during x-ray irradiation. A method is recommended for studying defence conditioned reflexes in rats. When the rats are irradiated with doses of 350 to 700 r the conditioned and unconditioned defence reflexes become higher. When the irradiation is continued some animals display an inhibition of the higher nervous activity, whereas in others—the initial excitation (in doses of 200 to 400 r) repeatedly alternates with inhibition and new waves of excitation. (auth)

6147

THE INFLUENCE OF X-RAY IRRADIATION ON THE LEVEL OF NUCLEIC ACIDS IN THE LIVER AND SPLEEN OF RABBITS. L. Cheika (Cejka) and Ya. Nosek (J. Nosek). Med. Radiol. 4, No. 12, 21-4(1959) Dec. (In Russian)

Changes in the content of nucleic acids in the liver and spleen of rabbits due to whole-body and local x-ray irradiation were studied. (auth)

6148

THE MECHANISM GOVERNING THE DERANGEMENT IN THE LEVEL OF ADRENALINE AND ADRENALINE-LIKE SUBSTANCES IN THE BLOOD AND AQUEOUS HUMOR OF RABBITS FOLLOWING TOTAL IRRADIATION. A. F. Maslova. Med. Radiol. 4, No. 12, 36-41(1959) Dec. (In Russian)

The changes in the content of adrenaline, noradrenaline, and oxidation products in rabbits after total irradiation were studied. These changes involved two phases of the sympathin content rise in the blood and aqueous humor. The mechanism of the above changes was analyzed. (auth)

6149

THE COURSE OF EXPERIMENTAL TUBERCULOSIS IN CONDITIONS OF IONIZING IRRADIATION. L. B. Akselrod, E. D. Duboviy, N. D. Golban, A. A. Konshin, T. M. Tsitko, and E. P. Tsyban. Med. Radiol. 4, No. 12, 48-52(1959) Dec. (In Russian)

Studies on rabbits revealed that whole-body irradiation (400 r) temporarily arrested the progress of the tuberculous process and lengthened the life span of animals as compared with the control group. The effect of similar irradiation on uninfected animals, who were kept together with the infected ones, provoked spontaneous infection with tuberculosis. (auth)

6150

THE DEVELOPMENT OF LEUKEMIA UNDER THE INFLUENCE OF IONIZING RADIATION. V. N. Streltsova. Med. Radiol. 4, No. 12, 66-79(1959) Dec. (In Russian)

A review is given of the effects of ionizing radiation on the development of leukemia. The relationships of the types and peculiarities of leukemia, the morpho- and pathogenesis, and relations between the frequency and character of leukemia to the dosage of absorbed radiation are analyzed. 110 references. (R.V.J.)

6151

REGULAR CHANGES OF LEUKOCYTIC REACTIONS DUE TO THE INTRODUCTION OF SODIUM NUCLEATE TO ANIMALS WITH RADIATION SICKNESS. P. V. Simonov (Kirov Military Medical Academy of Order of Lenin, USSR). Med. Radiol. 4, No. 12, 80(1959) Dec. (In Russian)

Leukocyte reactions to intravenous injections of radioactive sodium were studied in 72 rabbits exposed to 100, 250, 400, 800, and 1200 r. Previous works indicated three phases of leukocytic change in blood due to irradiation. The experiments established that each of the three phases

can be described by regular stages of distortion in leukocytic reaction. (R.V.J.)

6152

THE EFFECT OF X-RAYS ON THE ACTIVITY OF XANTHINE OXIDASE AND ALDEHYDE DEHYDRASE OF THE LIVER OF WHITE RATS. K. I. Pravdina and L. A. Tiunov. Med. Radiol. 4, No. 12, 81-2(1959) Dec. (In Russian)

Irradiation of white mice with x rays (700 r) stimulated xanthine oxidase activity in the liver tissue and depressed the activity of aldehyde dehydrase. The general liver tissue dehydrating ability was altered considerably after 12 to 25 days following the exposure. (R.V.J.)

6153

IMPORTANCE OF THE TYPE OF METABOLISM FOR THE RADIOSENSITIVITY OF MICE. M. Pospíšil and L. Novák (Czechoslovak Academy of Sciences, Brno). Nature 184, Suppl. 23, 1814-15(1959) Dec. 5.

The effects of pre-treatment with dried thyroid gland on the radiosensitivity of mice were studied. Reaction mechanisms involved are discussed. (C.H.)

6154

EFFECT OF WHOLE-BODY X-IRRADIATION ON THE INSULIN RESISTANCE OF FASTED RATS. V. Stankovic and N. Sestan (Institut Ruder Bosković, Zagreb, Yugoslavia). Nature 184, Suppl. 23, 1816(1959) Dec. 5. (In English)

Starvation did not alter the ability of the pituitary-adrenal system to respond to the stimulus provided by whole-body irradiation. Results are reported from a series of studies on rats. (C.H.)

6155

CELLS WHICH SYNTHESIZE DEOXYRIBONUCLEIC ACID IN GUINEA PIG BONE MARROW DURING RECOVERY FROM WHOLE-BODY γ-IRRADIATION. P. F. Harris and J. H. Kugler (Univ. of Sheffield, Eng.). Nature 184, Suppl. 24, 1883-4(1959) Dec. 12.

Round cells observed in irradiated guinea pig bone marrow before the final regeneration of substantial numbers of granulocytes and erythroid cells were divided into two groups according to their ability to synthesize desoxyribonucleic acid. Cells intermediate in appearance between small lymphocytes and blast cells appeared capable of synthesis while small round cells, resembling small lymphocytes, showed no evidence of synthesis. (C.H.)

6156

INACTIVATION BY IONIZING RADIATION OF COENZYME A IN VARIOUS CELLS. F. Hutchinson and C. Norcross (Yale Univ., New Haven). Radiation Research 12, 13-19 (1960) Jan.

The inactivation of coenzyme A by ionizing radiation in several different cells is reported. The data indicate that in these cells the radicals formed in water by ionizing radiation can migrate a distance of the order of 20 to 40 A before reacting, or roughly the thickness of the water layer surrounding a large molecule in a cell. Part of the coenzyme A in some of the cells is so resistant to the action of ionizing radiation that it indicates that sensitive groups on the molecule are not usually in direct contact with water. (auth)

6157

SHORTENING OF THE LIFE SPAN OF MICE BY IRRADIATION WITH X-RAYS AND TREATMENT WITH RADIOMIMETIC CHEMICALS. Peter Alexander and Dorothea I. Connell (Royal Cancer Hospital, London). Radiation Research 12, 38-48(1960) Jan.

The life span of CBA mice was greatly reduced by exposure to 600, 1100, and 1300 r of x rays given in two to four sessions 3 weeks apart. The resistance to further x irradiations of these heavily irradiated animals was not reduced. The single acute lethal dose was unchanged so long as more than 3 weeks were allowed to intervene between the last sublethal dose and the test dose used to determine the LD_{50}. The radiation does not hasten typical changes seen in unirradiated aging animals, such as alterations in collagen and the appearance of a liver lesion. The few facts so far available do not indicate that the process is similar to spontaneous aging. Cytotoxic chemical substances can also, under suitable conditions, cause a shortening of life span. Experiments are under way to examine if this effect is due to the production of somatic mutations or is due to destruction of cells. There are some very preliminary indications that the latter mechanism is more probable. (auth)

6158

A HISTOCHEMICAL STUDY OF DEOXYRIBONUCLEASE II IN LYMPHOID TISSUES OF NORMAL AND IRRADIATED RATS. W. G. Aldridge, L. H. Hempelmann, and V. M. Emmel (Univ. of Rochester). Radiation Research 12, 49-60(1960) Jan.

The distribution of DNase II and acid phosphatase in the spleen and thymus of rats given a lethal dose of x rays has been studied by histochemical methods. It was observed that the increase in activity of these enzymes per milligram of tissue is due in part to localization in radioresistant cells which survive 24 hours after exposure. These cells were classified morphologically as reticular cells and macrophages. It was not possible to determine quantitatively whether or not there had been enzyme synthesis in response to the presence of increased substrate from dead cells in the area. By inference from other studies and from the observations in this paper, it seems quite possible that such synthesis does occur. (auth)

6159

MUTATION AS A CAUSE OF DEATH IN OFFSPRING OF IRRADIATED RATS. J. F. McGregor, A. P. James, and H. B. Newcombe (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiation Research 12, 61-6(1960) Jan.

The incidence of infant death (stillbirth and death up to weaning) was studied in litters sired by x-irradiated male rats. Litters were conceived throughout a 24-day period after irradiation. A quantitative assessment of the relative importance of direct and indirect genetic components was made. The major cause of increased infant death in combined litters from conceptions at all times following irradiation was found to be indirectly genetic, i.e., a result of reduced litter size. However, a significant increase in death among litters conceived at 5 to 8 days after irradiation could be attributed to direct genetic causes. (auth)

6160

THE EFFECT OF CHARGED PARTICLE IRRADIATION ON GERMINATION OF BACILLUS SUBTILIS. J. Edward Donnellan, Jr. and Harold J. Morowitz (Yale Univ., New Haven). Radiation Research 12, 67-78(1960) Jan.

Experiments are reported on the effects of heavy charged particle irradiation on the germination process of B. subtilis spores. The possible mechanisms of inactivation admitted by the data are discussed. The sensitive units responsible for the various steps in the germination process are inactivated independently, and

the mechanism of inactivation is the same for all the units observed. (auth)

6161

STUDIES ON RADIATION-INDUCED MAMMARY GLAND NEOPLASIA IN THE RAT. I. THE ROLE OF THE OVARY IN THE NEOPLASTIC RESPONSE OF THE BREAST TISSUE TO TOTAL- OR PARTIAL-BODY X-IRRADIATION. E. P. Cronkite, C. J. Shellabarger, V. P. Bond, and S. W. Lippincott (Brookhaven National Lab., Upton, N. Y.). Radiation Research 12, 81-93(1960) Jan.

Total-body exposure of 40-day-old female Sprague-Dawley rats to 400 r of 250-kvp x rays delivered in a single dose was followed by a 79% tumor incidence in rats with one or more neoplasms of the breast at the end of 10 months postexposure. The incidence of breast neoplasms in nonexposed rats of the same age was 2%. The over-all incidence of nonbreast tissue neoplasms was 2% and distributed in all groups with and without radiation exposure. Exteriorizing and shielding the ovaries, or transplanting nonexposed ovaries into ovariectomized irradiated rats, or shielding the head did not reduce the incidence of breast neoplasms below 69%. Shielding the ovarian area reduced the incidence slightly to 40%. Removal of the ovaries before or after total-body radiation reduced, but did not eliminate, neoplasia of the breast in 19 to 23%. A further reduction to 25% occurred when the day of exposure was delayed to 120 days of age, although this group was studied for only 6 months postexposure. Exposure of the ovaries alone or ovariectomy or sham ovariectomy did not induce neoplasia of the breast. These results were interpreted to mean that total-body radiation or exposure of all of the animal except the ovaries or the head induces neoplasia of the breast. The presence of functioning ovary is required for the maximum neoplastic response of the breast to radiation. Reasons were presented for believing that 400 r of total-body radiation both hastens the onset of neoplasia of the breast and induces a higher incidence of neoplasia of the breast than would be expected to occur if the nonexposed rats were allowed to live out their life span. The histological types of neoplasms of the breast were, in decreasing order of occurrence, adenofibroma, adenocarcinoma, fibroadenoma, and fibrosarcoma. When multiple neoplasms were found in the same animal, the neoplasms were usually of the same type. Although the adenocarcinomas were noted to appear somewhat earlier and the adenofibromas somewhat later, no further correlation of histological type with any radiation, shielding, or surgical treatment was found. The relatively short period of time between exposure and the development of a high incidence of breast neoplasms suggests that the young female Sprague-Dawley rat offers many advantages in studies of neoplasia induction by total-body radiation. (auth)

6162

STUDIES ON RADIATION-INDUCED MAMMARY GLAND NEOPLASIA IN THE RAT. II. THE RESPONSE OF CASTRATE AND INTACT MALE RATS TO 400 r OF TOTAL-BODY IRRADIATION. C. J. Shellabarger, S. W. Lippincott, E. P. Cronkite, and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). Radiation Research 12, 94-102(1960) Jan.

Male Sprague-Dawley rats, both castrates and intact, had a 50% incidence of breast neoplasms 16 months after exposure to 400 r of 250-kvp total-body x radiation delivered as a single dose on the fortieth day of age. The dose was measured in air with scattering material in place. Nonexposed intact or castrate Sprague-Dawley male rats of the same age had an incidence of 0 or 6%, respectively. In the time period studied, total-body irradiation induced more breast tumors than were found in nonirradiated rats, and after consideration of the report that nonexposed male rats of this strain allowed to live out their life span have an incidence of neoplasms of the breast that does not exceed 10%, it is suggested that total-body irradiation can be an agent that may hasten onset of neoplasms and also induce a higher incidence of neoplasms of the breast of the male Sprague-Dawley rat. As compared to the reported neoplastic response of the breast of the female Sprague-Dawley rat, the following differences were noted. The latent period between exposure and appearance of breast neoplasms was prolonged in the male; the total incidence of rats with breast neoplasms was lower in the male; and more neoplasms of the breast of the males were classified as fibrosarcoma. From these findings, it was concluded that although both male and female rats of the Sprague-Dawley strain respond to total-body irradiation by the formation of neoplasia of the breast, gonadal hormones can influence the frequency, latent period, and histological appearance of the induced neoplasms. (auth)

6163

RESPONSE OF THE KANGAROO RAT (DIPODOMYS MERRIAMI MEARNS) TO SINGLE WHOLE-BODY X-IRRADIATION. Thomas J. Haley, R. G. Lindberg, A. M. Flesher, K. Raymond, W. McKibben, and Page Hayden (Univ. of California, Los Angeles). Radiation Research 12, 103-11(1960) Jan.

The responses of the kangaroo rat (Dipodomys merriami Mearns) to single whole-body x irradiation in the dosage range 25 to 550 r have been studied. The ST_{50} of this species at 550 r was 10.3 (9.7 to 10.9) days, which is almost identical with that of the CF-1 mouse. Observations were made of the following: total erythrocytes, total leukocytes, differential cell count, platelets, hemoglobin, hematocrit, bone marrow, and adrenal, kidney, spleen, and body weights. The responses of the kangaroo rat were essentially the same as those observed in the albino rat, but the general symptomatology was different, reflecting, in part, the difference in intestinal flora. In the nonirradiated kangaroo rat, the lumphocyte comprises 81.4% of the total leukocytes, and the spleen has an average weight of only 33 ± 2.88 mg. (auth)

6164

BIOCHEMICAL MODIFICATIONS INDUCED BY IONIZING RADIATIONS IN HEPATIC CELLS: SUCCINIC DEHYDROGENASE ACTIVITY. F. Pozza, C. Ruffato, and G. Verza (Università, Padua). Radiol. med. 45, 685-7(1959) July. (In Italian)

After exposure to x radiation (2000 r single dose and 2000 r fractionated dose during a four-week interval) the succinic dehydrogenase activity of the liver of rats was determined 1 and 24 hours after exposure. The results showed that the enzyme function does not depend on the factor time and it is only slightly increased in the case of a single radiation exposure. (tr-auth)

6165

RELATIVE BIOLOGICAL EFFECTIVENESS OF 0.4–1.8 MEV NEUTRONS FOR ACUTE EFFECTS IN THE MOUSE. J. L. Bateman, V. P. Bond, and Elmer E. Stickley (Brookhaven National Lab., Upton, N. Y.). Radiology 74, 90-1 (1960) Jan.

Results indicate a progressive increase of neutron RBE

for both mouse spleen and thymus, with decreasing energy in the 0.43- to 1.80-Mev range. Neutron doses were approximately 25, 50, 85, and 115 rads. Results were compared with effects of 250-kv x rays on mice. Data are presented graphically and results are discussed. (C.H.)

6166

COMBINATION OF VASODILATORS AND RADIATION IN EXPERIMENTAL TUMOR THERAPY. Morton M. Kligerman, Fred M. Palace, Dora Kyryk, and Harold L. Atkins (Yale Univ., New Haven). Radiology 74, 94-6(1960) Jan.

Results are reported from a study of the effects of decreased oxygen tension on the radiosensitivity of tumors. Irradiation was administered to tumor-bearing mice after the administration of acetylcholine, a sympathetic blocking agent, or tolazoline, a vasodilator. (C.H.)

6167

MICROANGIOGRAPHY OF BONE IN THE STUDY OF RADIATION CHANGES. Harley C. Carlson, Marvin M. D. Williams, Donald S. Childs, Jr., Malcolm B. Dockerty, and Joseph M. Janes (Mayo Clinic, Rochester, Minn. and Mayo Foundation, Rochester, Minn.). Radiology 74, 113-14(1960) Jan.

Results are reported from a study of possible vascular changes in bone following irradiation of rat legs and an evaluation of microangiography in demonstration of the changes. (C.H.)

6168

MODIFICATIONS IN THE BIOLOGICAL EFFECT OF X RADIATION WITH RESPECT TO THE RHYTHMIC FRACTIONATION OF THE RADIATION BEAM. Mario Bellucci (Università, Perugia, Italy). Radioterap. radiobiol. e fiz. med. (3) 14, 188-204(1959). (In Italian)

The variations in the biological effects caused by continuous and pulsed x radiation were studied on Bombyx mori eggs and on turnip, millet, and endive seeds. The eggs were exposed to 500 to 3000 r, and the pulsed beam had frequencies from 4 to 24 pulses/sec. The seeds were exposed to doses of 1500 and 3000 r, and the pulsed beams had frequencies of 20 pulses/sec. The results on Bombyx mori showed that pulsed irradiation, rather than continuous radiation, had the greater biological effects. This was especially clear with a frequency of 20 pulses/sec. The results obtained with seeds also demonstrated that pulsed radiation doses caused more biological effects than continuous radiation. (J.S.R.)

6169

ALKALINE PHOSPHATASE AND DEHYDROGENASE OF THE IRRADIATED KIDNEY. G. Dragoni and F. Paolini (Università, Pavia, Italy). Radioterap. radiobiol. e fis. med. (3) 14, 226-35(1959). (In Italian)

The behavior of the phosphatase and dehydrogenase activity of the irradiated kidney was studied by histochemical methods in the rat. The alterations found, consisting of the decrease in the enzymatic activity, occur early and are a function of the dose administered and of the time between the end of the exposure and the sacrifice of the animals. (tr-auth)

6170

CONTRIBUTION TO THE STUDY OF THE EVENTUAL INDIRECT AND DISTANT EFFECTS OF IONIZING RADIATION ON HEMATOPOIETIC TISSUES. A. Trenat, A. Ferrata, G. Prenna, and A. Cecchini (Università, Pavia, Italy). Radioterap. radiobiol. e fis. med. (3) 14, 236-48 (1959). (In Italian)

The indirect and distant effects of ionizing radiation on hematopoietic tissues were studied in vitro. This method permits the irradiation of the culture medium separately from the cells and the exclusion of any direct effects of the radiation on the cellular elements. It was not possible, within the limits of experimental error, to show the existence of a secondary effect of the radiation on the erythroblasts and granuloblasts of the bone marrow. It was observed that the cells surviving in plasma directly irradiated show no variation from the normal with respect to their proliferative yield. The same type of cells directly exposed to irradiation are greatly inhibited in their capacity to reproduce. (tr-auth)

6171

EXPERIMENTS CONCERNING BIOLOGICAL RADIATION PROTECTION. XXXIII. INFORMATION: FURTHER EXPERIMENTS ON THE MECHANISM OF THE PROTECTIVE EFFECT OF 5-HYDROXYTRYPTAMINE. Hanns Langendorff and Hans-Joachim Melching (Universität, Freiburg i. B.). Strahlentherapie 110, 505-9(1959) Dec. (In German)

Further animal experiments on the effect of 5-hydroxytryptamine for radiation protection are reported. The results indicate a lack of high-energy phosphate and a damage of the decarboxylase due to the influence of high energy radiation which are necessary for the synthesis of 5-hydroxytryptamine out of 5-hydroxytryptophane. (auth)

6172

STUDY OF THE EFFECTS OF THE ADRENAL GLAND AFTER WHOLE-BODY IRRADIATION OF MICE WITH DOSES IN THE CONSTANCY REGION (3.5-DAY EFFECT). Georg Gerber (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 510-17(1959) Dec. (In German)

Following whole-body irradiation of adrenalectomized mice with doses between 1000 and 15,000 r the usual survival time of 3.5 days can no longer be found. The animals die earlier, depending on the dose. Administration of adrenal cortex hormone restores the regular survival time. Following irradiation of the head adrenalectomized animals also have a shortened survival time, depending on the dose. There is little effect of adrenalectomy if the trunk was irradiated. High hormone doses are not able to prolong the survival time over 3.5 days. At very high doses of irradiation, when the survival time depends on the dose, however, cortisone has a protection effect. (auth)

6173

FRACTIONATED IRRADIATION OF THE BRAINS OF RABBITS WITH 31 MEV BETATRON. Hans Ernst (Universität, Zurich). Strahlentherapie 110, 518-28 (1959) Dec. (In German)

A report is presented on fractionated irradiation of the brain of 6 rabbits with a 31 Mev betatron. The dose was 12,000 and 15,000 r. Epilation, loss of weight, and compulsive poise of the head were noted in all animals, rotation around the own axis in 3 animals. A postmortem examination showed severe damage of the vessels, and necrosis particularly in the white matter were found in 4 animals. One animal showed mostly changes of the permeability. The 6th animal demonstrated no significant changes at the histologic examination, which is within the limits of biologic distribution. The average interval between completion of irradiation and onset of symptoms was 100 days. The survival time of the animals irradiated with 15,000 r was shorter than the survival time of the

other animals. The primary cause of the cerebral damage was considered due to damage of the vessels followed by hemorrhage and changes of the permeability. The severe changes of the equipoise may be due to damage of the labyrinth. They were observed in one animal without cerebral damage, which had purulent otitis. The eyeground and the optic nerve showed no changes in any of the animals. (auth)

6174

EXPERIMENTAL ANIMAL STUDIES ON THE COURSE AND THE REPARATION OF RADIATION INDUCED BONE DAMAGE. Karl-Heinz Ueberschär (Städt. Krankenhaus Moabit, Berlin). Strahlentherapie 110, 529-40 (1959) Dec. (In German)

On adult guinea-pigs the course and the reparation of a radiation induced bone damage by 5000 r irradiation of the thigh was studied. The studies revealed a direct radiation induced necrosis of the osteocytes in most of the cases during the first weeks following the irradiation. Radiation induced vascular changes were considerably later observed. Their extent effects the course of reparation. Effective reactions were found only in fractures. (auth)

6175

STUDIES OF THE ADDITIVE EFFECT OF X-RAYS AND ETHYLENIMINO-OXYBUTEN ON ANIMAL TUMORS. Erwin Haas (Universitäts-Hals-Nasen-Ohrenklinik, Mainz). Strahlentherapie 110, 541-7(1959) Dec. (In German)

We can establish that through the additional treatment with ethylenimino-oxybuten in experiments on animals, a clear increase of the radiative effectiveness in the sense of an additive effect is possible. Our results of investigation agree extensively with N-oxide-lost whose intensification of the effectiveness has been proved, and allows reason for the possibility that ethylenimino-oxybuten possesses a similar attacking point as that of x rays. (auth)

6176

THE RADIATION EXPOSURE OF THE POPULATION THROUGH LUMINOUS DIALS OF WATCHES AND CLOCKS. Walter Seelentag and Erich Klotz (Universität, Munich and Städt. Krankenanstalten, Augsburg). Strahlentherapie 110, 606-21(1959) Dec. (In German)

Counts on 38 clocks and watches revealed average radium equivalent contents of 0.12 μg on big alarm-clocks, 0.08 μg on travel alarm-clocks, 0.03 μg on small alarm-clocks, and 0.04 μg on wrist watches. The radiation exposure of the owners was accordingly 0.15, 0.10, 0.05, and 0.06 μr per hour. Counts and statistical material reveal an average radiation exposure of the population of 2.6 mr per year. The local exposure of the lower arm is about 300 μr per hour. The somatic exposure of the selling staff is about 90 mr per year. Although this type of radiation is undesired, a serious hazard is not given by the luminous dials. (auth)

6177

EFFECT OF GAMMA RAYS OF RADIOISOTOPE Co^{60} ON CERTAIN BIOCHEMICAL AND PHYSIOLOGICAL PROPERTIES OF MAIZE GRAINS DURING STORAGE. A. D. Chmyr (Odessa Technological Inst.). Ukrain. Biokhim. Zhur. 31, 671-80(1959). (In Ukrainian)

It was established that the dehydrase activity of maize grains is reduced with an increase in the radiation dosage. With a dose of 2.5 Mr, the dehydrase activity in dry grain decreases by 25%; in moist grain, by 30%. The respiration intensity of maize grain falls with an increase in radiation dosage. With a radiation dose of 2.5 Mr, the respiration intensity of dry grain is lowered 2.9 times, and the moisture, 4 times. High doses of radiation (2.5 Mr) are not lethal for the embryo cells of the seed, but considerably depress its respiration. Thus, with a dose of 2.5 Mr, the respiration intensity of the embryo cells is decreased 15 to 18 times. During storage for a term of 360 days, the respiration intensity and dehydrase activity of dry grain subjected to gamma-ray radiation remain unaltered. In the course of storage for a term of 90 days, there is practically no change in the respiration intensity and dehydrase activity in moist seeds irradiated with a dose of 2.5 Mr. (auth)

Radiation Sickness

6178 AF-SAM-60-1

Texas. Univ., Galveston. Medical Branch and School of Aviation Medicine, Brooks AFB, Tex.

INITIAL CLINICAL REACTION TO THERAPEUTIC WHOLE-BODY X-RADIATION—SOME CIVIL DEFENSE CONSIDERATIONS. William C. Levin, Martin Schneider, and Herbert B. Gerstner. July 8, 1959. 10p.

Early clinical events displayed by 11 cancer patients after whole-body roentgen treatment in a single large dose are compared with previous reports on radiation sickness and with acute sequelae observed in nuclear accidents. From this comparison, the typical initial reaction to penetrating radiation in the several-hundred-roentgen range emerges as follows: signs and symptoms, essentially in form of fatigue, nausea, and vomiting, begin to develop within 2 to 4 hours after exposure; they reach a climax between 5 and 8 hours after exposure; and they subside on the second or third day. During the intense phase of the disturbance, extending from approximately 4 to 10 hours post-exposure, about 60% of the irradiated persons experience disability of various degrees. Despite its transitory nature the reaction may present a major medical problem in civil defense situations because of coincidence and, thereby, of interference with evacuation plans and first-aid procedures. Therefore, the early sequelae of exposure to penetrating radiation require the attention of all physicians who may have to manage such emergencies. (auth)

6179 AEC-tr-3924

ACUTE RADIATION SICKNESS AND ITS DELAYED CONSEQUENCES. ABSTRACTS OF REPORTS AND INFORMATION ON THE CONFERENCE OF OCTOBER 19 TO 21, 1959. (Ostraya Luchevaya Bolezn i ee Otdalennye Posledstviya. Referaty Dokladov i Soobshcheniĭ na Konferentsii 19–21 Oktyabrya 1959). B. A. Lapin, ed. Translated by Lydia Venters (Argonne National Lab.) from a publication of the Institute of Experimental Pathology and Therapy of the Academy of Medical Science of the USSR, Sukhumi, 1959. 36p. OTS.

Summaries are presented of results from a series of studies on the pathology and therapy of radiation sickness in monkeys. (C.H.)

6180

EFFECT OF CHLORPROMAZINE ON THE SURVIVAL OF IRRADIATED RATS. E. H. Betz, D. J. Mewissen, and J. Closon (Université, Liège). Arch. intern. pharmacodynamie 121, 134-45(1959) Aug. (In French)

The survival of rats exposed to whole-body X irradiation is increased by a previous injection of chlorpromazine (5 mg/rat). The best protective effect is obtained when

chlorpromazine is injected 3 or 4 hours before the irradiation. After injection of chlorpromazine, the body temperature decreases and reaches its minimum after 3 or 4 hours. There is a close parallelism between the protective effect of the drug and the degree of hypothermia at the moment of the irradiation. It is doubtful that hypothermia alone may explain the protective effect of chlorpromazine. It may be that the drug acts directly on the metabolic activities of various tissues. (auth)

6181

ON POLYHEDRAL DISEASE IN THE SILKWORM INDUCED BY X-RAYS. A. E. Karpov (Inst. of Zoology, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 9, 1015-18(1959). (In Ukrainian)

Eggs and caterpillars of various instars of the silkworm (breed US–1) were irradiated with soft x rays (λ = 1.2 A), using doses from 1,000 to 80,000 r in order to study polyhedrosis morbidity. Irradiation of eggs with doses over 10,000 r resulted in the death of practically all the embryos but no polyhedrosis was detected. Irradiation of caterpillars with doses from 10,000 to 80,000 r also caused a very high mortality (62 to 97%) due to physiological weakness and to a lesser extent to bacterial diseases. Irradiation with doses from 1,000 to 6,000 r did not perceptibly affect the development of the caterpillars, but resulted in a significant increase in the frequency of polyhedral disease as compared with the controls. This increase was especially marked when the caterpillars were irradiated with doses of 5,000 to 6,000 r (33.5 ± 3.2% polyhedrosis-diseased individuals as compared with 8.4 ± 1.8% in the controls). As shown by infection tests, the susceptibility of caterpillars to polyhedrosis did not increase after irradiation. This leads to the conclusion that irradiation causes an activation of latent virus in the silkworm. (auth)

6182

CHANGES OF THE HIGHER NERVOUS ACTIVITY IN EXPERIMENTAL CHRONIC RADIATION SICKNESS INDUCED BY IONIZING RADIATION. Kh. Kh. Yarullin. Med. Radiol. 4, No. 12, 16-21(1959) Dec. (In Russian)

The changes of the higher nervous activity in 3 dogs (with different types of nervous system) due to chronic radiation sickness induced by daily x-ray irradiation (15 r) were studied. The results disclose not only a high radiosensitivity of the cortex of cerebral hemispheres, but also an extraordinary high plasticity and great compensatory defensive possibilities of the higher portions of the central nervous system. They were manifested by a cyclic and undulating character of disturbances of conditioned reflex activity with a tendency towards normalization even after a total dose of 765 r in dogs of the weak type, 1335 r in those of the excitable type, and 1440 r in dogs of the strong balanced type of nervous system. The data obtained divulge a dependence of the character of higher nervous activity disturbances on the individual-typological peculiarities of the animals. Along with that the data show an apparent dependence of the animals' radioresistance upon their type of nervous system. (auth)

6183

CHANGES OF MUCOPOLYSACCHARIDE CONTENT AND OF HYALURONIDASE INHIBITOR ACTIVITY IN THE BLOOD AND TISSUES DURING ACUTE RADIATION SICKNESS. Z. I. Sheremet, V. M. Manteifel, and M. O. Raushenbakh (Raushenbach). Med. Radiol. 4, No. 12, 25-36(1959) Dec. (In Russian)

The changes in the amount of polysaccharides and the hyaluronidase activity in the tissues of the small intestine, stomach, lungs, and blood serum of guinea pigs, white rats, and dogs at various periods of acute radiation sickness were studied. Mucopolysaccharides were determined by the content of glucosamine and tyrosine by Elson and Morgan's method and by the amount of mucoid isolated by Glass-Boyd's method. Biological membrane permeability, viscosimetric, and mucine clot formation methods were used for the determination of the fermentative activity of hyaluronidase. A decrease of mucopolysaccharide content was noted in the tissues of the small intestine, stomach, lungs, and liver during the development of radiation sickness in guinea pigs. In rats a short-term reduction of mucopolysaccharide content was observed in the small intestine; in the rest of the tissues its rise was revealed. Serum mucoproteid content increased in all the animals after the irradiation. No rise of the hyaluronidase activity was noted under the effect of irradiation in the tissues investigated. Properties of the blood serum and of some tissue extracts inhibiting hyaluronidase activity were increased. Treatment of acute radiation sickness with hyaluronic acid and vitreous body did not prove successful. (auth)

6184

ON THE SPECIES, ORGAN AND ORGANIC SPECIFICITY OF TISSUE ANTIGENS IN IRRADIATED ANIMALS. R. V. Petrov and L. I. Il'ina (Ilyina). Med. Radiol. 4, No. 12, 41-7(1959) Dec. (In Russian)

It was established on white rats that in acute radiation sickness the species antigenic specificity of tissues remains unchanged. A decline of organic antigenic specificity and the change of the organoid (of mitochondria and microsoma) was observed. (auth)

6185

THE PROTECTIVE ROLE OF FOOD IN ACUTE RADIATION AFFECTION OF THE ORGANISM. S. R. Perepelkin and G. I. Bondarev. Med. Radiol. 4, No. 12, 53-8(1959) Dec. (In Russian)

The protective role of food in irradiation of rats with a dose of 600 r was studied. The data revealed a large survival rate of animals kept on milk-egg diet, while that of animals who were given a low animal protein diet was lower. The physiological and milk-egg diets in this respect were in the intermediate position. The enrichment of the rations with vitamin C, P, and B complex (B_1, B_2, PP, B_6, and folic acid) taken in relatively low and large doses, but with changed vitamin correlation (a decrease of the vitamin C, P, and PP content and an increase of others) led to a considerable rise of the protective role of all diets, especially of the physiological and meat rations, against the action of ionizing radiation. It was noted that large quantities of vitamins effected a higher curative and preventive action than the two other variants, low doses and those with an altered correlation. (auth)

6186

FAILURE OF CYSTEINE GIVEN POSTIRRADIATION TO PROTECT THE HIBERNATING GROUND SQUIRREL. Douglas E. Smith (Argonne National Lab., Lemont, Ill.). Radiation Research 12, 79-80(1960) Jan.

Cysteine failed to protect hibernating ground squirrels against injuries induced by exposure to 1,000-r x radiation. (C.H.)

CHEMISTRY

General and Miscellaneous

6187 AECU-4553

Case Inst. of Tech., Cleveland.

PRODUCTION OF SINGLE CRYSTAL COPPER FILMS AT LOW TEMPERATURES. Technical Report No. 5. Arthur Yelon. Apr. 1959. 16p. Contract AT(11-1)-623. OTS.

A method is described for the production of single crystal films of copper at temperatures as low as −40°C. This method utilizes the epitaxy of copper on rocksalt. A thin layer of copper (about 120A) is evaporated on the salt at 350°C. Then a thick layer (about 1500A) is evaporated at the low temperature. Films grown by this method have been examined with x-rays and microscopically while they were being etched. It was found that some of these films had single crystal regions of 0.04 inches diameter and larger. These crystallites had [100] directions within 1° to the normal to the film surface. (auth)

6188 AECU-4561

Massachusetts Inst. of Tech., Cambridge and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

PHOTOMETRIC TITRATION OF WEAK BASES IN NON-AQUEOUS MEDIA. L. E. I. Hummelstedt and David N. Hume. [1959]. 31p. Contract AT(30-1)-905. OTS.

The photometric titration technique is used for the determination of weak bases using perchloric acid in acetic acid as titrant and acetic acid or acetonitrile as solvent. Differentiating titration of as many as four components in a single mixture is shown to be possible. Comparison with potentiometric titrations in the same media shows the photometric technique to be preferable in many instances where the bases to be differentiated are very similar in strength. The versatility of the photometric procedure in differentiating bases is greatly increased by the device of changing wavelength during titration of mixtures. (auth)

6189 AECU-4611

Utah. Univ., Salt Lake City.

ADSORPTION OF ORGANIC ACIDS ON THORIA. Technical Report V. Harold R. Bradford and Milton E. Wadsworth. Dec. 31, 1959. 10p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract No. 1075. OTS.

The adsorption of acetic and oleic acids on the surface of thoria was studied by means of infrared spectroscopy. An infrared analysis of the adsorbates before and after adsorption using differential double beam methods indicated that the adsorption of organic acids on thoria surfaces occurs by an esterification reaction between the organic acid and the hydroxylated thoria surface. Ammonia vapor will not adsorb on thoria, indicating the basic character of the hydroxylated surface. (auth)

6190 AECU-4612

Utah. Univ., Salt Lake City. Inst. of Metals and Explosives Research.

THE SURFACE CHEMISTRY OF THORIA. Progress Report [for] February 1, 1959 to January 31, 1960. Harold R. Bradford, Chong S. Cho, Charles H. Hausenfleck, Ralph M. Horton, Frederic Megerth, David A. Reese, Russell A. Schalow, Lowell G. Tensmeyer, and Milton E. Wadsworth. Jan. 1, 1960. 9p. For [Oak Ridge National Lab.]. Contract W-7405-eng-26, Subcontract No. 1075. OTS.

The use of chloroplatinic acid to platinize the thoria surface produced a much more active catalyst than did the metal. The addition of colloidal silica in excess of 0.42 g per g thoria produced an apparently stable catalyst as did thoria with a platinum surface coverage of 0.34 g (no silica present). The effects of slurrying, refiring, and oxygen–hydrogen pretreatment are reported. The surface adsorption and reactivity of the oxides of Cr and Mo and Na_2SO_4 with thoria under hydrothermal conditions are reported. Chromium oxide shows no reactivity up to 48 hrs and 290°C. Molybdenum oxide shows no reaction up to 24 hrs, while between 24 and 48 hrs at 290°C extremely slow reaction takes place. Surface adsorption of sulfates takes place up to 290°C. Infrared studies indicate the adsorbed species on the surface as the bisulfate ion. The preparation of thoria for infrared studies on the surface adsorption of hydroxyl groups is described. The kinetics of silica transfer from colloidal silica to the thoria surface are discussed. (For preceding period see AECU-4345.) (C.J.G.)

6191 CF-60-1-99

Oak Ridge National Lab., Tenn.

DIFFERENTIAL THERMAL ANALYSIS. QUALITATIVE STUDY OF NITRATE–BUTYL PHOSPHATE SYSTEMS. W. H. Baldwin. Jan. 25, 1960. 12p. Contract [W-7405-eng-26]. OTS.

An evaluation of differential thermal analysis for the study of nitrate-organic reactions was given. In tributyl phosphate saturated with nitric acid an exothermic reaction was initiated near 150°C. Nitrate salts were found to be involved in exothermic reactions at higher temperatures usually after an endothermic reaction at lower temperatures. (auth)

6192 GA-942

General Atomic Div., General Dynamics Corp., San Diego, Calif.

HIGH-TEMPERATURE CHEMISTRY OF FISSION-PRODUCT ELEMENTS. Summary Report [for] July 26, 1958 to August 1, 1959. Ulrich Merten and W. E. Bell. Sept. 2, 1959. 31p. Project No. 35. Includes Appendix: THE DISSOCIATION PRESSURE OF RUTHENIUM TRICHLORIDE. W. E. Bell, M. C. Garrison, and Ulrich Merten. J. Phys. Chem. 64, 145-6(1960). Contract AT(04-3)-164. (GA-892). OTS.

An analysis of the effects of vapor diffusion in ruthenium–chlorine system transpiration experiments was used for interpreting the results of experiments in which the effects of flow rate on the quantity of vapor transported were studied. Data are presented graphically for the $RuCl_3$–Cl_2 system at 700°C by plotting the gas flow rate against the vapor transport. Vapor-pressure studies in the ruthenium–chlorine system are reported, and data at 600 to 1000°C are given. Results show that the chlorine effect is due to $RuCl_4$ rather than $RuCl_3$ (g) as originally assumed. $RuCl_3$ (g) apparently becomes important at higher temperatures. Data and discussions related to pressure dependence of the solid-vapor equilibrium are presented for the Ru–Cl_2 system. Also, data on the temperature dependence for the equilibrium of the $RuCl_3$–$RuCl_4$ gaseous and solid systems are included. Thermodynamic properties of gaseous ruthenium chlorides are also listed. Data on the dissociation of rhodium chloride were obtained, and vapor pressures of the rhodium–chlorine system at 800 and 900°C are tabulated. Palladium chloride was also studied and data on the dissociation pressure at 700 to 850°C are given along with data on effects of chlorine in the system Cl–Pd on vapor pressure. The dissociation of $RuCl_3$ was determined at 650 to 839°C by static and dynamic methods. (For preceding period see GA-461.) (J.R.D.)

6193 GAT-T-697

Goodyear Atomic Corp., Portsmouth, Ohio.

AMMONIUM URANIUM(V) FLUORIDE AND POTASSIUM URANIUM(V) FLUORIDE—A PRELIMINARY REPORT.

G. A. Rampy. Nov. 2, 1959. 13p. Contract AT(33-2)-1. OTS.

The preparation of NH_4UF_6 and KUF_6 and some of the properties of solutions of these compounds in aqueous HF are described. A quantitative analytical method for the determination of U(V) in these compounds is also discussed. (J.R.D.)

6194 HW-62450

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSIENT PRESSURES DEVELOPED BY SODIUM–NITRIC ACID REACTIONS. C. E. Huck and J. J. Shefcik. Oct. 21, 1959. 4p. Contract AT(45-1)-1350. OTS.

Scouting studies were made to determine hydraulic pressures developed when Na is exposed to cold concentrated HNO_3 beneath the liquid surface. The peak hydraulic pressures developed when Na reacted beneath eight feet of cold 60% HNO_3 were 250, 700, and 850 psi for four, eleven, and twenty-two grams of Na, respectively. The peak pressures persisted for about 0.5 milliseconds. As many as seven pressure peaks were observed for a single reaction with the highest peak at or near the beginning of the reaction. The force developed when the largest quantity of Na reacted was sufficient to displace the 700-pound dissolver assembly about one foot horizontally. (W.L.H.)

6195 IS-50

Ames Lab., Ames, Iowa.

MISIDENTIFICATIONS IN THE ARC SPECTRA OF THE RARE EARTHS. R. N. Kniseley, V. A. Fassel, and C. F. Lentz. Nov. 1959. 21p. Contract W-7405-eng-82. OTS.

In the course of developing spectrographic methods for the analysis of the rare-earth elements, a number of errors in the MIT wavelength tables became apparent. These errors consist of either misidentifications of the spectral lines or discrepancies in the intensities assigned to the lines. Both of these errors were apparently caused by the unrecognized presence of rare-earth impurities in the rare earths whose spectra were investigated. In order to establish whether or not the lines in question were correctly identified, spectrograms of highly purified rare-earth fractions from ion exchange columns were studied. In this manner it was possible to follow the lines of the impurity elements through successive fractions until they either disappeared or leveled off at an intensity which represented the intensity of the underlying lines of the matrix rare earth. In addition, spectrograms of previously analyzed rare-earth oxides which were known to be the purest obtainable were examined for possible misidentified lines. A listing of the lines which are either misidentified or whose intensity assignments are erroneous is presented. (auth)

6196 JEN-63

Spain. Junta de Energia Nuclear, Madrid.

INSTALACIÓN ELECTROLÍTICA PARA LA OBTENCIÓN DE DEUTERIO Y LLENADO DE DEPÓSITOS A PRESIÓN. (Electrolytic Installation in Order to Obtain Deuterium and to Fill the Pressure Deposits). F. Cordero Lopez and A. Tanarro Sanz. 1959. 15p.

In order to obtain deuterium for the feed of accelerator ion sources, a simple and automatic electrolytic installation was constructed. The installation, used with a small compressor, can fill pressure vessels of 1 to 2 liter capacity with deuterium up to a pressure of 4 atmospheres in a few hours of operation. The electrolytic cell has a "V" shape and can operate with only 3 cc of heavy water. The electrodes are platinum and NaOH solution in the proportion of 15 wt.% is the electrolyte. The operation is automatic. The compressor is small, and the charge is low so that an auxiliary motor is not needed. The compressor piston is the only moving part. Deuterium losses are practically zero. (auth)

6197 JEN-64

Spain. Junta de Energia Nuclear, Madrid.

PREPARACIÓN DE MONOCRISTALES DE NAFTALENO PARA CONTADORES DE CENTELLEO. (Preparation of Naphthalene Monocrystals for Scintillometers). Rafael Gaeta. 1959. 21p.

A method for the preparation of naphthalene monocrystals for scintillation counters is described. The various methods of preparation and the reasons for the selection o the Bridgman method are analyzed. The thermal curves of the crystal-growing furnace, the ampoule shape, use of curved capillaries, and the best growing velocities are studied in detail. Methods for the preparation of high-purity crystals by chromatography and zone melting are discussed. The operation of cutting and polishing the crystals was studied, and the most significant physical properties of the crystals were determined. (auth)

6198 NAA-SR-3737

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SALINE WATER CONVERSION, 1956–1958. A Literature Search. Frank G. Bennett, IV, comp. Jan. 1960. 11p. OTS.

This literature search contains 140 references. (W.L.H.)

6199 NAA-SR-Memo-713

North American Aviation, Inc., [Downey, Calif.].

SULFUR AS A POSSIBLE REACTOR COOLANT. T. T. Shimazaki. June 5, 1953. 6p. OTS.

It was found that liquid sulfur can be used as a reactor coolant only if a suitable additive can be found which reduces its viscosity to less than 0.005 lb/ft sec at 500 to 900°F. Such a viscosity would render sulfur comparable to sodium. (J.R.D.)

6200 NP-8222

Wyandotte Chemicals Corp., Wyandotte, Mich. and Illinois. Univ., Urbana.

SYNTHESIS AND EVALUATION OF HIGH TEMPERATURE STABLE AND NUCLEAR RADIATION STABLE METAL-CYCLOPENTADIENYL FLUIDS. Progress Report No. 9 Covering Period September 1, 1959 to November 30, 1959. Dec. 31, 1959. 45p. Project Nos. 9-(2-3044) and 9-(8-7312). Contract AF33(616)-5053.

In a search for liquids suitable for use as high-temperature hydraulic fluids, potential routes to perfluoroalkylbenzimidazole polymers, bis(phenoxyphenyl)-ferrocenes, and polychloroferrocenes were investigated. The major product from the reaction of perfluoroglutaric acid with o-phenylenediamine was 4-(2-benzimidazolyl)-hexafluorobutyric acid (50%). Alkylation of 2-trifluoromethylbenzimidazole with methyl iodide produced 1-methyl-2-trifluoromethylbenzimidazole (80%), but similar alkylation with 1,3-diiodohexafluoropropane was unsuccessful. Efforts to prepare intermediates to phenylcyclopentadiene from 3-phenylcyclopentene were unsuccessful. The reaction of cyclopentadiene with 1,3-dichloro-5,5-dimethylhydantoin in methanol yielded crude methoxychlorocyclopentene (39%), which reacted with phenylmagnesium bromide to give phenylmethoxycyclopentene (46%). From an investigation of the lithiation and subsequent carbonation of dimethylferrocene, the enantiomorphic forms of 1,1'-dimethylferrocene-3-carboxylic acid were isolated via their cinchonidine and quinidine salts, and 1,1'-dimethylferrocene-2-carboxylic acid and a mixture of diacids were also obtained. Unsuccessful were attempts to

prepare 1,1'-diaminoferrocene, to unite hydroxymethylferrocene with unsaturated fatty esters, and to improve the yields in the preparations of nitro- and azoferrocene. Oxidation of methylferrocene and ethylferrocene with manganese dioxide gave formyl- and acetylferrocene, respectively. (auth)

6201 NP-8226

Wyandotte Chemicals Corp., Wyandotte, Mich.

THE SYNTHESIS AND EVALUATION OF NEW BASE STOCK FLUIDS FOR GAS TURBINE APPLICATION. Quarterly Progress Report No. 1 Covering Period September 1 to November 30, 1959. Dec. 1, 1959. 53p. Contract AF33(616)-6749.

A program was initiated for the synthesis of new pyrazine derivatives for evaluation as prospective gas turbine lubricants. Attention was primarily directed at preparing various new 2-substituted-3-methylpyrazine intermediates. It is contemplated that these intermediates will be subsequently further reacted at the methyl side chain to provide higher molecular weight liquid materials suitable for the end use. A successful route was established to 2-substituted-3-methylpyrazines in which the substituents are certain phenoxy, thiophenolate and aniline radicals. The preparation of these materials was afforded in good yield by the interaction of 2-chloro-3-methylpyrazine with the appropriate sodium phenoxide, sodium thiophenolate and aniline, respectively. These intermediates are liquids or low-melting solids boiling in the range of 536 to 688°F at atmospheric pressure. Some discoloration of these compounds was noted at or near their boiling points, suggesting questionable stability at these temperatures. Such instability may be inherent in the methyl substituent which is common to all of these intermediates. The attempted preparation of 2-(N,N-diphenylamino)-3-methylpyrazine by the interaction of sodium diphenylamine with 2-chloro-3-methylpyrazine yielded only a small amount of the anticipated product along with a polymethylpyrazine side product containing a presumed small number of methylpyrazine units. The action of sodium amide in liquid ammonia upon 2-chloro-3-methylpyrazine produced a dimeric product, 2-chloro-3-(3-methyl-2-pyrazylmethyl)pyrazine. Attempts to prepare 2-siloxide-3-methylpyrazines and 2-silyl-3-methylpyrazines by various routes have so far been unsuccessful. The conversion of a methylene radical in a pyrazine compound to the presumably more stable difluoromethylene group was demonstrated by the transformation of the model compound, phenacylpyrazine, to α,α-difluorophenacylpyrazine with the aid of perchloryl fluoride. (auth)

6202 NP-8243

General Electric Co., Pittsfield, Mass.

EVALUATION OF EXPERIMENTAL POLYMERS—AGING TESTS CONDUCTED IN THE THERMOBALANCE AND EMPIRICAL TESTS IN DRY NITROGEN. Progress Report No. 6 [for] September 1, 1959 to December 1, 1959. Charles D. Doyle. Dec. 15, 1959. 88p. Project No. 7340. Contract AF33(616)-5576.

Kinetic analyses are given for four polymers of increasingly complex kinetic process, as aged in dry N_2 at constant elevated temperatures in the thermobalance. The polymers were polytetrafluoroethylene, polystyrene, a chlorendicanhydride-hardened epoxy resin, and an experimental polymer, the reaction product of aconitic acid and acetic anhydride. A general equation is given for relating static aging times at elevated temperatures to TGA temperatures, and it is shown that in theory, the type of kinetic process can be discerned from TGA data alone. For the empirical comparison of materials, a new comprehensive index of thermal stability, the "integral decomposition temperature," or "idt," is derived on the basis of two areas under the thermogram. An improvemen in DTA technique is described, together with a second corroborative method, here called "thermoparticulate analysis," or "TPA." (auth)

6203 NYO-2297

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE ADAPTATION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. Semi-annual Progress Report for the Six-Month Period Ending October 31, 1959. 80p. Contract AT(30-1)-956. (MITS-42). OTS.

A study of the adsorption of potential determining ions and amines on silver sulfide was initiated. The adsorption of hydrogen and hydroxyl ions on two preparations of ferric oxide was studied by potentiometric titration. An attempt was made to establish the reproducibility and reversibility of the adsorption of Ag^+ and I^- on AgI and to establish that the analytical zero point of the charge (zpc) as determined by electrochemical titration lies between pAg 5.5 and 6. The streaming potential study on hematite was continued. The study of the absorption of amine on MgO was terminated. The study of hysteresis of contact angles for the three phase system of water, organic liquid, and mineral was continued. A study is reported of the variations of impeller speed, air flow rate, and flotation time in a batch flotation cell. A study of the oxidation of elemental sulfur in the presence of oxidants dissolved in water is presented. (For preceding period see NYO-2294.) (W.L.H.)

6204 NYO-2595

Consolidation Coal Co. Research and Development Div., Library, Penna.

UTILIZATION OF RADIOACTIVE ISOTOPES IN COAL PROCESS RESEARCH. Quarterly Technical Status Report No. 3 [for] September 1, 1959—November 30, 1959. P. M. Yavorsky and E. Gorin. Dec. 15, 1959. 30p. Contract AT(30-1)-2350. OTS.

Large quantities of tetralin have been tagged with tritium by the Wilzbach technique. The tagged product has been chromatographically purified to remove products of radiation damage and is now available for use as a chemical process tracer. Pilot tagging reactions have been successfully carried out with small quantities of phenanthrene and a hydrogenated coal oil, both of which suffered little, if any, radiation damage. Studies have been initiated on chemical identification of the distribution of the tritium in tagged tetralin. A successful procedure has been worked out for dehydrogenation to naphthalene. Assay of the tritium content of the product naphthalene has not been completed due to equipment difficulties. A procedure for oxidation to phthalic anhydride is also being developed. Segregation and mixing rates of various size coal particles in a fluidized bed have been obtained using the radio-tracer technique. Mixing rates were found to be very rapid both for particles finer and coarser than those in the fluidized bed initially, but very slow for particles the same size as the bed. The mixing rate of a given size particle is relatively independent of the particle size distribution in the bed. Pronounced and very sharp segregation between different size particles is observed in the fluidized bed. (auth)

6205 NYO-4520

Johns Hopkins Univ., Baltimore.

CONTAMINATION AND DECONTAMINATION PROPERTIES OF TEXTILE FIBERS WITH RESPECT TO I^{131}. Progress Report. A. P. Talboys and R. A. Buckingham. June 15, 1952. 20p. Contract AT(30-1)-946. (JHUL-1). OTS.

Laboratory tests were conducted to compare various

natural and synthetic textile fibers for extent of contamination upon exposure to solutions containing I^{131}. All of the fibers tested proved to be more highly contaminated under moderately acid than under alkaline conditions. Acrilan and asbestos tended to be most susceptible to contamination, while bleached Ardil, Saran, Teca, cotton (except absorbent), and wool were among the staple fibers showing the least contamination. In some instances, dyed and bleached fibers reacted differently from the untreated forms. Fibers contaminated under alkaline conditions were found to be more easily decontaminated by water rinsing than those exposed to acid solutions of I^{131}. With some samples, virtually complete decontamination was accomplished with only one or two rinses, while with others significant amounts of I^{131} were retained after four rinses. Nylon proved most difficult to decontaminate with water, while Saran, cotton, and Acrilan showed fairly good decontamination characteristics. (auth)

6206 NYO-7946

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

A THERMODYNAMIC STUDY OF SOME COORDINATION COMPLEXES OF METAL IONS WITH DIPROTIC NITROGEN COMPOUNDS CONTAINING ONE HETEROCYCLIC NITROGEN ATOM. David E. Goldberg and W. Conard Fernelius. Dec. 1958. 13p. Contract AT(30-1)-907. OTS.

Formation constants were determined for 2-picolylamine, 2-picolylmethylamine, and 2-(2-aminoethyl)pyridine with copper, nickel, cobalt(II), zinc, and cadmium ions over the temperature range 10 to 40°C. Formation constants for iron(II) were determined at 30° with 2-picolylamine and 2-picolylmethylamine. Stabilization due to dative pi bonding was shown by dividing the free energy of formation of a stepwise chelation reaction by the free energy of formation of an entirely protonated ligand. The denominator in such a ratio was used as a measure of the strength of the sigma bond in the chelation process, and thus a high ratio would indicate stabilization other than by sigma bonding. It was shown that the amines expected to show pi-bond stabilization had higher ratios than did similar amines which could not form pi bonds. (auth)

6207 ORNL-2810

Oak Ridge National Lab., Tenn.

LEACHING OF TAMALPAIS DEBRIS. W. D. Bond and W. E. Clark. Jan. 28, 1960. 10p. Contract W-7405-eng-26. OTS.

From Tamalpais debris crushed to < 53 μ, 5.5, 19.6, and 12.5% of the alpha, beta, and gamma activities, respectively, were leached in 72 hr at room temperature by a 100 to 1 weight excess of ground water from the Nevada test site. The extracted alpha-activity material was > 97% Pu^{239} and < 3% Am^{241}, and the gamma was 92% Ru^{106}, 4.7% Zr–Nb^{95}, and 3.1% Cs^{137}. The beta activities could not be identified. The ground water leached 10 to 20 times as high a percentage of activity from Tamalpais debris as from Rainier debris in a previous study, but on a count rate basis the total activity released to the ground water was a factor of 2 greater for Rainier than for Tamalpais. Increasing the leaching temperature from room temperature to boiling doubled the amount of active material extracted. Increasing the particle size classification from < 53 to 590-1190 μ decreased the extraction efficiency approximately 3-fold. (auth)

6208 ORNL-2875

Oak Ridge National Lab., Tenn.

COMPARISON OF A FLUIDIZED-BED AND AN AGITATED-THROUGH CHEMICAL REACTOR FOR PRODUCING ThO_2 FROM $Th(NO_3)_4$. S. D. Clinton. Feb. 12, 1960. 19p. Contract W-7405-eng-26. OTS.

The continuous conversion of $Th(NO_3)_4$ solution to form 100- to 500-μ-diam. ThO_2 particles was tested in both a fluidized bed and an agitated trough. Neither method was feasible for producing dense high-strength ThO_2 spheres. Instead of depositing uniform oxide layers on the hot surface of the bed particles, the $Th(NO_3)_4$ decomposed to form loosely bound ThO_2 agglomerates. (auth)

6209 ORNL-2878

Oak Ridge National Lab., Tenn.

THE CATALYSIS OF THE HYDROGEN–OXYGEN REACTION BY AQUEOUS SLURRIES OF THORIUM OXIDE AND THORIUM–URANIUM OXIDE. N. A. Krohn. Feb. 9, 1960. 79p. Contract W-7405-eng-26. OTS.

Aqueous slurries of thorium oxide and thorium oxide containing uranium were investigated for their catalytic activity for the reaction of hydrogen and oxygen to form water. Pure thorium oxide, thorium-uranium oxide mixed crystals prepared by calcining coprecipitated oxalates, and thorium oxide with uranium oxide sorbed on the surface were used after calcining at 650, 800, and 1000°. The reaction rates were found to be first order with respect to hydrogen pressure and zero order with respect to oxygen pressure in all cases at temperatures from 230 to 300° and total gas pressures from 100 to 2000 psi. For the pure thorium oxide an average activation energy of 41 kcal/mole and an average frequency factor of 4.6×10^8 moles/psi H_2-hr-g of ThO_2 were found. Addition of uranium lowered both factors, the maximum effect giving a ΔE_a of ~14 kcal with an A of $\sim 10^{-2}$. Actual rates for all catalysts were within one order of magnitude when compared on a unit surface area basis. This compensation effect was explained on the basis of a two-site process, one site being related to the uranium concentration on the catalyst surface and the other characteristic of pure thorium oxide. A few tests on uranium trioxide slurries gave initial fast rates followed by slow ones, the change being accompanied by reduction of the surface uranium under the experimental conditions. The apparent activation energy for both surface conditions was 26 kcal/mole based on first order rate constants with frequency factors of 2.2×10^4 and 2.5×10^3 moles/psi H_2-hr-g for the initial and final rates, respectively. (auth)

6210 ORO-227

Kentucky. Univ., Lexington.

REARRANGEMENTS IN 3-ARYL-1-BUTYL SYSTEMS. Final Report. Arthur W. Fort and Robert E. Leary. Oct. 15, 1959. 118p. Contract AT(40-1)-2067. OTS.

3-Phenyl-1-butylamine-3-C^{14} and 3-p-anisyl-1-butylamine-3-C^{14} have been prepared and treated with sodium nitrite in acetic acid. Four products, 3-aryl-1-butyl acetates, 3-aryl-1-butenes, and erythro- and threo-3-aryl-2-butyl acetates, were produced in each reaction. Little or no isotope-position rearrangement attended the formation of 3-aryl-1-butyl acetates and 3-aryl-1-butenes, but extensive rearrangement was observed in the 3-aryl-2-butyl acetates. Results obtained in this work indicate that aryl- and hydrogen-bridged ions were intermediates in the formation of secondary acetates and that open secondary carbonium ions were not intermediates in these reactions. Solvolysis reactions of 3-aryl-1-butyl brosylates and chlorides and octyl brosylate and chloride in several solvents have been examined briefly. All solvolysis reactions proceeded predominantly by an $S_{N}i$ mechanism. (auth)

6211 UCRL-8910

California. Univ., Berkeley. Lawrence Radiation Lab.

ELECTRON-SPIN-RESONANCE AND CHEMICAL STUDIES OF RADIATION DAMAGE OF CHOLINE CHLORIDE AND

SOME OF ITS ANALOGS (thesis). Robert O. Lindblom. Oct. 19, 1959. 122p. Contract W-7405-eng-48. OTS.

The extreme sensitivity of choline chloride to ionizing radiation was investigated with electron spin resonance (ESR) spectroscopy and some chemical kinetic studies. The selectively deuterated analogs of choline chloride were synthesized to aid in the interpretation of the ESR hyperfine spectrum of the radiation-produced radicals in choline chloride. The hyperfine structure was found consistent with a radical structure of : $CH_2 \cdot CH_2 - OH$. These radicals were then related to the radiation damage rate by means of kinetic studies on the radical decay, and the radiation damage rates. A $^3/_2$-order decay rate was observed for the radical disappearance rate. A chain-decomposition mechanism has been proposed to account for this $^3/_2$ order, and the integrated rate law has been compared with the choline decomposition rate. The model requires the observed radical to be in the form of a stabilized radical rather than the chain-propagating species. A new ESR standard was developed for the kinetic studies. It consists of a dilute solution of Mn^{+2} in a superpure MgO matrix. Since its spectrum is nearly clear at G = 2.0023, it is particularly convenient for use with radicals centered there. (auth)

6212 WADC-TN-57-430

TRG, Inc., New York.

PROPERTIES OF POLYETHYLENE AND RELATED POLYMERS. Chonon Heller, Saul Levinson, and Carole Nudelman. Apr. 1957. 53p. Project No. 6-(1-9964). Contract AF33(616)-3616. (AD-207338). OTS.

Polyethylene has been used for a wide variety of applications. This report covers several of the more important methods of synthesis. Physical and mechanical properties of polyethylene are determined by the structure and crystallinity. The structure of polyethylene, polymethylene, and related polymers are compared and discussed. The interaction of polyethylene and radiation are treated with respect to cross linking, gas evolution, change in melting point, change in composition, and changes in crystallinity. (auth)

6213 WAPD-SFR-PD-111

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

ION EXCHANGE PERFORMANCE OF MIXED BED AMMONIUM–HYDROXYL RESINS. Status Report. G. P. Simon and W. J. Singley. June 12, 1956. 36p. Contract AT-11-1-GEN-14. OTS.

The results from a series of tests to determine the effectiveness and expected life of ammonia resin for corrosion product removal in pressurized water reactor systems are discussed. (auth)

6214 AEC-tr-3929

KINETICS OF THE INTERACTION OF HYDROGEN WITH OXYGEN ON PLATINUM. E. N. Khar'kovskaya, G. K. Boreskov, and M. G. Slin'ko. Translated for Atomics International Div. from Doklady Akad. Nauk S.S.S.R. 127, 145-8(1959). 7p. JCL or LC.

The catalytic activity of Pt with relation to the interaction of hydrogen with oxygen within a wide temperature range of concentration changes was determined. The fixed circulating method was, permitting the measurement of the reaction velocity directly under isothermic conditions, in a fixed state and in the absence of the distorting influence of hydrodynamics. The Pt was used in the form of 0.1-mm wire with composition 99.88% Pt–0.03% Pd–0.06% Ir. The actual wire surface amounted to 51 cm^2. The experiments were conducted within a temperature range of 20 to 180°C, under a pressure of from 50 to 750 mm Hg, and with various mixtures of hydrogen, nitro-hydrogenous, nitrogen, nitro-oxygen, and oxygen. (W.L.H.)

6215 AEC-tr-3960

MECHANICAL THERMAL STABILITY OF CRYSTALS OF SOME EXPLOSIVES. K. K. Andreev. Translated for Los Alamos Scientific Lab. from Nauch. Doklady Vysshei Shkoly, Khim. i Khim. Tekhnol., No. 2, 244-6(1959). 6p. JCL or LC.

The difference in the tendency of various explosives to detonate, and the transition of burning to detonation are considered. Explanations of the bases of these tendencies are given and examples are included. It is noted that PETN, which exhibits high combustion temperature, melting point, and burning rate should crack more easily than TNT even if the particle sensitivity to temperature differences of both substances are identical. Experimental results show that large crystals (0.8 to 5 mm) of PETN detonate as easily as a powder consisting of particles smaller than 0.1 mm. The stability of explosives may be increased by coating the surface with a viscous inert film which diminishes the rate of heating and penetration of gases. (J.R.D.)

6216 CEA-tr-R-760

UTILISATION DES ATOMES MARQUÉS DANS L'ÉTUDE DE LA CHIMIE DES COMPLEXES. (Utilization of Labeled Atoms in the Study of the Chemistry of Complexes). V. I. Spitsyn (Spitzine). Translated into French from Acta Chim. Acad. Sci. Hung. 12, 119-40(1957). 41p.

After a review of tracer studies in inorganic complex chemistry, some experiments on exchange of labeled W between complexes and tungstate are reported. Kinetic studies showed that normal Na_2WO_4 is transformed slowly to paratungstate in acid solution, not instantaneously. Some indication was found that a bond exists between hexatungstate anions and hexamolybdate anions and heteropoly anions. No such bond was found for metatungstate. A relatively high mobility was found for the addition products of central groups in heteropoly compounds, making isotopic and ionic exchange possible between them. These exchanges are stepwise. The H atoms in the polyhydrates studied (para- and metatungstates) and O atoms in paratungstates had high mobilities, lending weight to the idea of "particular" molecules of water in polyhydrates. (T.R.H.)

6217 UCRL-Trans-100

RATE OF REDUCTION OF SILICA BY CARBON, CARBORUNDUM, FERROSILICON AND CRYSTALLINE SILICON. P. V. Gel'd, A. G. Kologreeva, and N. N. Serebrennikov. Translated by Bonnie E. Cushman from Zhur. Priklad. Khim. 21, 1261-71(1948). 22p. JCL or LC.

The rates of silica reduction by carbon, carborundum, silicon, and ferrosilicon in vacuo at 1130 to 1370°C were determined. The rates for silicon and ferrosilicon are almost the same and significantly greater than that of carbon and carborundum. (C.J.G.)

6218 UCRL-Trans-101

THE EQUILIBRIUM SYSTEM OF SILICON OXIDE. P. V. Gel'd and M. I. Kochnev (Kochner). Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Zhur. Priklad. Khim. 21, 1249-60(1948). 25p. JCL or LC.

Measurements of the vapor pressures of silicon oxide at 900 to 1150°C were made. On the basis of these data a series of thermochemical characteristics of SiO was calculated and an account of the equilibrium was established without resorting to a broad analogue between CO and SiO. An approximate dependence on temperature of the equilibrium constant of the reduction of SiO_2 by silicon, carbon,

and carborundum, and of SiO by the latter two, is shown. The largest effect is attained with the use of carbon, and the least with SiC. (J.R.D.)

6219 UCRL-Trans-126

ON THE ELECTRICAL POLARIZATION OF HYDROGEN ADSORBED ON CLEAN METAL SURFACES AND ITS EFFECT ON THE RECOMBINATION OF HYDROGEN ATOMS. R. Suhrmann and H. Csesch. Translated by S. Shewchuck (Univ. of California Radiation Lab.) from Z. physik. Chem. 28B, 215-35(1935). 29p. JCL.

Spectral photoelectrical sensitivity curves from data obtained before and after reaction of atomic hydrogen on clean Ag, Al, Tl, and Pt surfaces are presented. It is shown that the work function variation ($\Delta\phi$) for the hydrogen reaction according to the Fowler formulas depends linearly on the work function (ϕ). The relative catalytic activity is proportional to ϕ. The results were explained by the polarization of the H atoms in the electrical field of the metal surface. A mechanism of H recombination on metals was also deduced. (J.R.D.)

6220

CRYSTALLOGRAPHIC STUDIES ON SODIUM URANYL-8-QUINOLINATE, $Na.UO_2.(C_9H_6NO)_3$. V. Amirthalingam (Atomic Energy Establishment, Bombay). Acta Cryst. 13, 61(1959) Jan. (In English)

The cell dimensions of sodium uranyl-8-quinolinate were determined to be: a = 22.41, b = 14.42, c = 13.72A, $\beta = 98°30'$. The proposed space group is C_{2h}^4–C2/c. The sodium and uranium coördinates were determined. (C.J.G.)

6221

INVESTIGATION OF THE EQUILIBRIUM IN A REACTION IN WHICH BERYLLIUM OXIDE IS REDUCED BY CARBON AT HIGH TEMPERATURES. F. Sh. Muratov and A. V. Novoselova (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 129, 334-6(1959) Nov. 11. (In Russian)

Equilibrium in the reaction $BeO_{sol} + {}^3/_2\ C_{sol} \rightleftharpoons {}^1/_2\ Be_2C_{sol} + CO_{gas}$ is studied by manometric methods at 1400 to 2000°C. (R.V.J.)

6222

PREPARATION, PROPERTIES AND REACTIONS OF BISMUTH PENTAFLUORIDE. Jack Fischer and Edgars Rudzitis (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 81, 6375-7(1959) Dec. 20.

Bismuth pentafluoride was prepared by synthesis from bismuth and fluorine at 500°C. Its crystal structure, density of the solid and liquid, triple point temperature, and vapor pressure were determined and the latent heat of vaporization and Trouton constant were calculated. Various chemical reactions of bismuth pentafluoride, such as its reduction with hydrogen and fluorination reactions with various elements and compounds, were studied. Bismuth pentafluoride acts as a strong fluorinating agent. (auth)

6223

ACID-BASE REACTIONS IN FUSED SALTS. II. THE ABSOLUTE CONCENTRATION OF NO_2^+ ION IN FUSED NITRATE. F. R. Duke and S. Yamamoto (Iowa State Coll., Ames). J. Am. Chem. Soc. 81, 6378-9(1959) Dec. 20.

The reactions $S_2O_7^= + NO_3^- \rightarrow NO_2^+ + 2SO_4^=$ and its subsequent reaction $NO_2^+ + NO_3^- \xrightarrow{slow} 2NO_2 + O$ were studied kinetically at 235 and 275°C. The equilibrium in the first reaction was found to lie sufficiently far to the right so that its equilibrium constant could be determined. It was possible to establish a scale of acidity in fused nitrates based on the absolute concentration of NO_2^+. (auth)

6224

THE SOLUBILITY OF ALKALI METALS IN ETHERS. J. L. Down, J. Lewis, B. Moore, and G. Wilkinson (Imperial Coll., London). J. Chem. Soc. 3767-73(1959) Dec.

Potassium and sodium-potassium eutectic dissolve slightly (of the order of 10^{-4} g-atom/l) in certain ethers to give unstable blue solutions which are considered to be similar to the well-known blue solutions of alkali metals in ammonia and amines. Absorption spectra of the solutions show maxima at about 7000 A. An attempt was made to correlate the ability to give a blue solution with the structure and basicity of the ethers. (auth)

6225

A DEUTERIUM ISOTOPE EFFECT IN THE OXIDATION OF CYCLOHEXANOL BY CERIUM(IV). S. J. Littler (Dyson Perrins Lab., Oxford). J. Chem. Soc., 4135-6 (1959) Dec.

The deuterium isotope effect was studied using ceric sulfate oxidation of cyclohexanol. A study of the oxidation of ethanol by cerium(IV) in perchloric acid indicated stability constant K = 4.3 and a decomposition rate constant $k = 67 \times 10^{-4}$ sec^{-1} at 20°. The values K = 13.0 and $k = 1.38 \times 10^{-4}$ sec^{-1} at 50° were obtained for the cyclohexanol-ceric sulfate reaction. (B.O.G.)

6226

THE d AND f ELECTRONS IN THE COMPLEXES OF TRANSITION GROUPS. Christian Klixbüll Jørgensen (École Polytechnique, Copenhagen). J. chim. phys. 56, 889-96(1959) Nov.-Dec. (In French)

An atom or ion in the gaseous state has well defined L and S quantum numbers for the energy levels corresponding to spherical symmetry. These levels are described with a good approximation as appertaining to electron configurations where a whole number of electrons is found in each group of orbitals, characterized by n and l. In complexes of the three transition groups, the absorption spectra and several other properties can be explained by the field theory of liquids. The distribution of the energy states (Γ_n and S) produced by the orbitals with l = 2 (d electrons) is given with two types of parameters, the energy differences between the γ_n orbitals and the inter-electron repulsion, which is less in complexes compared with gaseous ions. In the rare earths and in the elements after thorium, one can observe internal transitions in $4f^n$ and $5f^n$ which are relatively little disturbed by the ligands and some 4f → 5d and 5f → 6d transitions. The names "actinides" and "uranides" for the 5f elements are discussed. The theory of molecular orbitals and the principle of microsymmetry are opposed to the theory of hybridation which can not predict the energy levels observed. (tr-auth)

6227

INVESTIGATIONS ON THE ADSORPTION OF RADIOELEMENTS IN SOLUTION. II. ADSORPTION OF Pu(IV) IN NITRIC MEDIUM. M. Haissinsky and Y. Paiss (Laboratoire Curie, Paris). J. chim. phys. 56, 915-19(1959) Nov.-Dec. (In French)

The adsorption of tetravalent plutonium on platinum, gold, stainless steel, and polyvinyl chloride from nitric solution increases with decrease in acidity. It is shown that in the case of platinum the adsorption increases with the decrease in H^+ and NO_3^- concentration. It follows the Langmuir isotherm, whereas the adsorption in steel and

polyvinyl chloride varies linearly with the concentration. An attempt to interpret the processes on metal surfaces is given by using the constitution mechanism of the double layer at the metal/solution interface. (tr-auth)

6228

STUDIES ON HYDRATED CERIC OXIDE. S. S. Moosath (Univ. of Kerala, Trivandrum, India). J. Inorg. & Nuclear Chem. 11, 286-9(1959) Dec.

The results of physico-chemical studies on hydrated ceric oxide, $CeO_2 \cdot 2H_2O$, are presented. By thermogravimetric and differential thermal analysis, earlier findings on the stability of ceric hydroxide at higher temperatures are disproved. Attempts were made to elucidate the structure of the material from x-ray-diffraction patterns and infra-red spectra. Results obtained from these studies suggest that hydration of ceric oxide destroys the fluorite structure. (auth)

6229

THE EFFECT OF FLUORIDE ION ON THE CO-ORDINATION OF URANIUM(IV) BY ETHYLENEDIAMINE TETRAACETIC ACID. T. D. Smith (Royal Coll. of Science and Tech., Glasgow). J. Inorg. & Nuclear Chem. 11, 314-19 (1959) Dec.

The effect of fluoride ion upon uranium(IV) solutions containing ethylenediamine tetraacetic acid is explained in terms of the participation of the UF^{3+} ion in co-ordination. The stability constant of this ion with ethylenediamine tetraacetic acid was measured and its value used to estimate thermodynamic quantities associated with the formation of the complex fluoride. The general co-ordinating tendency of UF^{3+} ion is discussed and compared with other systems of a similar nature. (auth)

6230

THE DEGENERATE C-H STRETCHING FUNDAMENTAL OF CH_3D. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Mol. Spectroscopy 4, 84-91(1960) Jan. (In English)

The vibration-rotation spectrum of the doubly degenerate C−H stretching fundamental of CH_3D was observed. From the structure of the band and previously known rotational constants the quantities $\zeta_{3b} = 0.08_6$, $\nu_{3b} = 3016.9\ cm^{-1}$, and $B_{3b} = 3.865\ cm^{-1}$ was obtained. This zeta value is in much better agreement with that calculated from the force constants than that found in the literature. (auth)

6231

THE THERMODYNAMICS OF DILUTE SOLUTIONS OF $AgNO_3$ AND KCl IN MOLTEN KNO_3 FROM ELECTROMOTIVE FORCE MEASUREMENTS. III. TEMPERATURE VARIATIONS OF THE ACTIVITY COEFFICIENTS. J. Braunstein and M. Blander (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 10-13(1960) Jan.

The quasi-lattice model of the molten reciprocal salt systems A^+, B^+, C^-, and D^- previously proposed by Blander leads to the relation for the activity coefficient of the component $AD_{\gamma AD} = [(1 - X)^Z[1 + X/\beta(1 - X)]^{Z-1}]/N_{D^-}$, if A^+ and C^- ions have an extra-coulombic interaction, where Z is the lattice coördination number, $\beta = e^{-\Delta E/RT}$, ΔE is the energy of formation of a mole of $A^+ - C^-$ ion pairs and X is the fraction of positions adjacent to A^+ ions occupied by C^- ions and can be calculated in terms of Z, ΔE, and the concentrations of the ions. The theory should be valid for low values of N_{Ag^+} and X. Measurements of the activities of $AgNO_3$ were made in a molten salt concentration cell for dilute solutions of Ag^+ and Cl^- ions at 385, 402, and 423°. KCl in solution lowered the activity coefficient of $AgNO_3$, the lowering being larger relative to the larger the concentration of Cl^- ions and the smaller the concentration of Ag^+ ions. A comparison of the experimental data and the theory at low values of N_{Ag^+} ($\leq 0.720 \times 10^{-3}$) and X (<0.15) for Z = 6 leads to a value of ΔE of $5.6_5 \pm 0.03$ kcal/mole for the temperature range studied (370−436°). The constancy of ΔE shows that the temperature coefficients of the activity coefficients in the range of validity of the theory are correctly predicted. (auth)

6232

PROTON RESONANCE SHIFTS IN NITRIC ACID SOLUTIONS OF ALUMINUM NITRATE. Robert C. Axtmann, Woodfin E. Shuler, and Bruce B. Murray (E. I. du Pont de Nemours and Co., Aiken, S. C.). J. Phys. Chem. 64, 57-61 (1960) Jan.

Proton magnetic resonance spectra were used to measure the dissociation of nitric acid between 25 and 80°C in solutions that were 0 to 1.5 M in aluminum nitrate. The salt repressed the dissociation of the acid markedly. At temperatures above room temperature, the salt was even more effective at diminishing the dissociation of the acid. The results at room temperature agree fairly well with a simple theory that combines a common ion effect due to the added nitrate ion and the assumption that water bound in the hydrated aluminum ion is unavailable for reaction with molecular nitric acid. (auth)

6233

THE HEATS OF HYDROLYSIS OF DIBORANE AND BORON TRICHLORIDE. Stuart R. Gunn and LeRoy G. Green (Univ. of California, Livermore). J. Phys. Chem. 64, 61-3(1960) Jan.

The heats of hydrolysis of B_2H_6 and BCl_3 were measured to determine the consistency of the heats of formation of the two compounds and to improve the derived values of the heats of formation of boric acid and boric oxide. Measured values of heats of hydrolysis are: $B_2H_6(g) + 2006H_2O(l) = 2(H_3BO_3 \cdot 1000H_2O) + 6H_2(g)$, $\Delta H = -112.22 \pm 0.10$ kcal $mole^{-1}$; $BCl_3(l) + 2403H_2O(l) = (H_3BO_3 + 3HCl) \cdot 2400H_2O$, $\Delta H = -68.68 \pm 0.06$. Derived values for the heat of formation of $H_3BO_3 \cdot 1000H_2O$ (from amorphous boron) from the two reactions are -257.70 ± 0.28 and -257.06 ± 0.33 kcal $mole^{-1}$, respectively. The standard heat of formation of B_2O_3 (from crystalline boron) is estimated to be -305.50 ± 0.45 kcal $mole^{-1}$. (auth)

6234

MISCIBILITY OF LIQUID METALS WITH SALTS. IV. THE SODIUM−SODIUM HALIDE SYSTEMS AT HIGH TEMPERATURES. M. A. Bredig and H. R. Bronstein (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 64-7 (1960) Jan.

The use of thermal analysis and of equilibration with a new method of sampling yielded improved data for consolute temperatures and compositions as well as for the solubilities of the metal in the molten salts in the lower temperature range. The consolute compositions of 28 mole % Na (at 1180°C), 50 mole % Na (1080°C), 52 mole % Na (1026°C), and 59 mole % Na (1033°C) for the NaF−Na, NaCl−Na, NaBr−Na, and NaI−Na systems, respectively, reflect the influence of the relative sizes of the metal and halide constituent on the symmetry of the phase diagrams. The depression of the melting point of the salt represented by the monotectic temperature and composition of the salt-rich phase corresponds to a positive deviation from Raoult's law similar to the one observed in the KX−K systems. A similar tentative interpretation, the association of the metal to diatomic molecules, is proposed. (auth)

6235

THE KINETICS OF THE REACTION BETWEEN URANIUM(IV) AND CERIUM(IV). F. B. Baker, T. W. Newton, and Milton Kahn (Los Alamos Scientific Lab., N. Mex. and Univ. of New Mexico, Albuquerque). J. Phys. Chem. 64, 109-12(1960) Jan.

The kinetics of the reaction between uranium(IV) and cerium(IV) was studied in perchloric acid–sodium perchlorate solutions at $\mu = 2$, over the perchloric acid concentration range 0.80 to 2.00 M. The rate for the principal reaction path was found to be proportional to both the $CeOH^{+3}$ and U^{+4} concentrations and inversely proportional to the hydrogen ion concentration. The thermodynamic quantities of activation in 2 M perchloric acid at 2.4° were found to be $\Delta H\ddagger = 14.0 \pm 0.7$ kcal/mole, $\Delta S\ddagger = 6.2 \pm 2.5$ e.u., and $\Delta F\ddagger = 12.2 \pm 0.2$ kcal/mole. A potentiometric study of the hydrolysis of cerium(IV) in the aforementioned media indicates $CeOH^{+3}$ to be the predominant species in solution over the perchloric acid concentration range from 0.300 to 2.00 M. (auth)

6236

THE SOLUBILITY OF SILVER SULFATE IN ELECTROLYTE SOLUTIONS. PART 6. HEATS AND ENTROPIES OF SOLUTIONS VS. TEMPERATURE. SPECIES PRESENT IN HNO_3 AND H_2SO_4 MEDIA. R. W. Stoughton and M. H. Lietzke (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 133-6(1960) Jan.

The concentrations of the various species present in 0.1, 0.5, and 1.0 M solutions of H_2SO_4 and of HNO_3 saturated with respect to Ag_2SO_4 are discussed as a function of temperature. The values of the solubility product, of the enthalpy and entropy of solution, and of the standard partial molal entropy of the solute Ag_2SO_4 are given vs. temperature to 200°C. (auth)

6237

THE DISSOCIATION PRESSURE OF RUTHENIUM TRICHLORIDE. W. E. Bell, M. C. Garrison, and Ulrich Merten (General Atomic Div., General Dynamics Corp., San Diego, Calif.). J. Phys. Chem. 64, 145-6(1960) Jan.

The dissociation pressure of $RuCl_3$ was measured at 650 to 839°C. From the slope of the log P versus 1/T line and an estimated ΔC_p of 4.5 cal/mole °K, $\Delta H^0_{1020°K} = -57.2 \pm 1.0$ kcal/mole and $\Delta H^0_{298} = -60.5 \pm 2.0$ kcal/mole for $Ru(s) + \frac{3}{2}Cl_2(g) = RuCl_3(s)$. S^0_{298} $RuCl_3(s)$ is calculated to be 30.5 eu, and the dissociation pressure is calculated to be 1 atmos at 853°C. No other ruthenium chlorides appear to exist as stable condensed phases in the temperature range investigated under chlorine pressures up to 1 atm. (auth)

6238

USE OF GLASS ELECTRODES TO MEASURE ACIDITIES IN DEUTERIUM OXIDE. Paul K. Glasoe and F. A. Long (Cornell Univ., Ithaca, N. Y.). J. Phys. Chem. 64, 188-90 (1960) Jan.

Glass electrodes were used to measure the acidity in D_2O solution. A pH meter reading in D_2O solutions was 0.40 pH unit lower than in H_2O solutions. This potential change was attributed to the glass electrode. (C.J.G.)

6239

THE VOLUME OF DIMERIC BISMUTH MONOHALIDE DISSOLVED IN MOLTEN BISMUTH TRIHALIDE. M. A. Bredig and H. A. Levy (Oak Ridge National Lab., Tenn.) and F. J. Keneshea and Daniel Cubicciotti (Stanford Research Inst., Menlo Park, Calif.). J. Phys. Chem. 64, 191(1960) Jan.

The molar volume and apparent molar volume of a dimeric bismuth monohalide dissolved in a molten bismuth trihalide are calculated for bromide and chloride at 250°C and for iodide at 420°C for the mole fractions $X_{Bi_2X_3}$ 0.039 and 0.177. (C.J.G.)

6240

THERMAL AND MAGNETIC PROPERTIES OF CERIUM ETHYL SULPHATE BETWEEN 0.02 AND 1°K. C. E. Johnson and H. Meyer (Univ. of Oxford). Proc. Roy. Soc. (London) A253, 199-211(1959) Nov. 24.

Adiabatic demagnetization experiments were carried out on a spherical single crystal of cerium ethyl sulfate. The absolute temperature scale was determined down to 0.02°K as a function of the entropy. Measurements were also made of the adiabatic susceptibility in the antiferromagnetic state which sets in at 0.05°K and by extrapolation the magnetization at T = 0°K could be estimated to a fair accuracy. The co-operative phenomena are discussed in terms of the theory of electric quadrupole-quadrupole interaction by Finkelstein. (auth)

6241

MOLYBDENOMETRY. COMMUNICATION 1. PREPARATION AND STANDARDIZATION OF TRIVALENT MOLYBDENUM SOLUTIONS. A. I. Busev and Li Gyn (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 668-76(1959) Nov.-Dec.

Standardized solutions of trivalent molybdenum have certain importance for analytical chemistry, as they are strong reducers, can be easily obtained by the reduction of ammonium molybdate with amalgamated zinc or on a lead amalgamated cathode, and are stable enough when stored and used in proper conditions. (auth)

6242

DIFFUSION OF HYDROGEN AND DEUTERIUM AT 4.2°K. R. F. Bulatova, V. S. Kogan, and V. G. Lazarev (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1492-3(1959) Nov. (In Russian)

The limits of hydrogen diffusion in deuterium and deuterium diffusion in hydrogen at 4.2°K were found. It is shown that the saturation point for hydrogen diffusion in deuterium is at 10% and for deuterium in hydrogen at 21%. The volume per molecule in both saturated solutions is ($\sim 35 A^3$) and is close to the volume assigned to each molecule in a pure lattice. (R.V.J.)

6243

SEALING IRRADIATED POLYETHYLENE SHEET MATERIAL. (to General Electric Co.). British Patent 825,945. Dec. 23, 1959.

A method is given for sealing containers of irradiated polyethylene. A free-radical-producing curing agent is applied to one or both surfaces to be bonded together. In one example polyethylene strips irradiated to 10^6 to 10^7 r were sealed together by unirradiated polyethylene and benzoyl peroxide applied in several different ways. (T.R.H.)

6244

METHOD FOR PRODUCING ISOTOPIC METHANES AND PARTIALLY HALOGENATED DERIVATIVES THEREOF. J. W. Frazer (to U. S. Atomic Energy Commission). U. S. Patent 2,900,424. Aug. 18, 1959.

A method is given for producing isotopic methanes and/or partially halogenated derivatives. Lithium hydride, deuteride, or tritide is reacted with a halogenated methane or with a halogenated methane in combination with free halogen. The process is conveniently carried out by passing a halogenated methane preferably at low pressures or in an

admixture with an inert gas through a fixed bed of finely divided lithium hydride heated initially to temperatures of 100 to 200°C depending upon the halogenated methane used.

6245

PROCESS OF OXIDIZING PLUTONIUM. C. D. Coryell (to U. S. Atomic Energy Commission). U. S. Patent 2,901,315. Aug. 25, 1959.

The oxidation of plutonium to the plus six valence state is described. The oxidation is accomplished by treating the plutonium in aqueous solution with a solution above 0.01 molar in argentic ion, above 1.1 molar in nitric acid, and above 0.02 molar in argentous ion.

6246

PREPARATION OF URANIUM TRIOXIDE. J. S. Buckingham (to U. S. Atomic Energy Commission). U. S. Patent 2,903,334. Sept. 8, 1959.

The production of uranium trioxide from aqueous solutions of uranyl nitrate is discussed. The uranium trioxide is produced by adding sulfur or a sulfur-containing compound, such as thiourea, sulfamic acid, sulfuric acid, and ammonium sulfate, to the uranyl solution in an amount of about 0.5% by weight of the uranyl nitrate hexahydrate, evaporating the solution to dryness, and calcining the dry residue. The trioxide obtained by this method furnished a dioxide with a considerably higher reactivity with hydrogen fluoride than a trioxide prepared without the sulfur additive.

6247

METHOD FOR PREPARATION OF UO_2 PARTICLES. J. R. Johnson and A. J. Taylor (to U. S. Atomic Energy Commission). U. S. Patent 2,905,528. Sept. 22, 1959.

A method is described for the preparation of high-density UO_2 particles within the size range of 40 to 100 microns. In accordance with the invention UO_2 particles are autoclaved with an aqueous solution of uranyl ions. The resulting crystals are reduced to UO_2 and the UO_2 is heated to at least 1000°C to effect densification. The resulting UO_2 particles are screened, and oversize particles are crushed and screened to recover the particles within the desired size range.

6248

PRODUCTION OF URANIUM METAL BY CARBON REDUCTION. R. B. Holden, R. M. Powers, and O. J. Blaber (to U. S. Atomic Energy Commission). U. S. Patent 2,905,552. Sept. 22, 1959.

The preparation of uranium metal by the carbon reduction of an oxide of uranium is described. In a preferred embodiment of the invention a charge composed of carbon and uranium oxide is heated to a solid mass after which it is further heated under vacuum to a temperature of about 2000°C to produce a fused uranium metal. Slowly cooling the fused mass produces a dendritic structure of uranium carbide in uranium metal. Reacting the solidified charge with deionized water hydrolyzes the uranium carbide to finely divide uranium dioxide which can be separated from the coarser uranium metal by ordinary filtration methods.

6249

PREPARATION OF HIGH DENSITY UO_2. J. M. Googin (to U. S. Atomic Energy Commission). U. S. Patent 2,906,598. Sept. 29, 1959.

A method is presented for the preparation of high-density UO_2 from UF_6. In accordance with the invention, UF_6 is reacted with water and concentrated ammonium hydroxide is added to the resulting aqueous solution of UO_2F_2. The resulting precipitate is calcined to U_3O_8 and the U_3O_8 is reduced to UO_2 with a gaseous mixture comprised of carbon monoxide and carbon dioxide at a temperature of from 1600 to 1900°C.

Analytical Procedures

6250 AERE-C/R-2809

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MEASUREMENT OF IMPURITIES IN HELIUM. PART II. INTERMITTENT ANALYSES BY GAS CHROMATOGRAPHY. M. Wilkins and J. D. Wilson. Sept. 1959. 76p. BIS.

Impurities in helium such as hydrogen, argon, oxygen, nitrogen, and carbon monoxide can be separated by gas chromatography using synthetic zeolite as an adsorbent. The conventional theory of gas–liquid partition chromatography was applied to fix the operating parameters of the columns, thus giving the requisite separations with the minimum sample dilution. Hydrogen, oxygen, and nitrogen can be separated at 0°C and oxygen and argon at −78°C. With samples of 10 ml, 5 to 10 ppm of each gas can be detected using a conventional katharometer. It was shown that it is essential to purify the carrier gas if a calibration free from systematic errors is to be obtained, since with this system of sample injection the chromatograph measures the differences in levels of the various impurities in the carrier gas and in the sample, respectively. (auth)

6251 BNL-581

Brookhaven National Lab., Upton, N. Y.

HIGH SENSITIVITY MASS SPECTROMETRY OF THE RARE GASES. Oliver A. Schaeffer. Dec. 1959. 14p. OTS.

A 60° sector type of mass spectrometer and associated sample preparation system adapted for ultrasensitive analysis of rare gas isotopic abundances is described. The electron bombardment ion source was designed to be stable over long periods with a high efficiency for ion production. The spectrometer uses a Hall crystal as a rapid method of mass identification when using magnetic scanning. The detector is a secondary electron multiplier. The isotope abundances are measured under static vacuum conditions and standardized by the introduction of known amounts of rare gases during the measurements. Accuracies of about ±5% are possible for the absolute amount of any particular isotope present. The mass spectrometer is capable of detecting 2×10^5 atoms of helium or 10^4 atoms of an argon isotope. The limiting factor in the isotope abundance measurement is the amount of natural abundance rare gas contamination added during the sample preparation. Vacuum fusion of the sample in a crucible inside a glass vacuum jacket (low helium diffusion rate) followed by purification with hot calcium and copper–copper oxide leads to the following contamination levels in units of cc at NTP: 10^{-10} for He^3, 10^{-9} for He^4, 4×10^{-9} for Ne^{20}, and 3×10^{-7} for Ar^{40}. The amounts for the other isotopes are in their natural abundance ratio. These sensitivities make it possible to measure nuclear reaction cross sections of the order of 1 mb when 10^{15} particles strike a target several g/cm^2 thick, in measuring the rare gases of a meteorite, or to measure the age of a million-year-old mineral by the K-Ar method. (auth)

6252 HW-59868

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FUELS PREPARATION DEPARTMENT ANALYTICAL LABORATORY MANUAL. June 1959. 104p. Contract AT(45-1)-1350. OTS.

Basic procedures for the analysis of AlSi, Bi, P-lead, Li, Ch_3OH, 60% HNO_3, 50% NaOH, steel, trichloroethylene, and TSPP are outlined. General analytical procedures are given for coal, ethylene glycol, grease, oil, and transformer oil. Routine control analysis for chemicals used in reactor fuel preparation are described. Procedures for operating a fluorophotometer and x ray are given, and the flash point analysis methods of the Cleveland open cup and the Tag closed cup are described. The determination of uranium in various solutions previously used in fuel preparation is discussed. (C.J.G.)

6253 KAPL-M-WSH-5

Knolls Atomic Power Lab., Schenectady, N. Y.

THE RELIABILITY OF DETERMINING IMPURITY TITANIUM IN ZIRCALOY. William S. Horton. Dec. 6, 1959. 20p. Contract W-31-109-Eng-52. OTS.

An attempt is made to assess data available from a group of laboratories upon the analysis of impurity titanium in Zircaloy by a variety of methods. Zircaloy samples at seven different levels of titanium concentration had been available. Conclusions are clouded because of the six methods, only two were used by more than one laboratory. Also it is not certain that all laboratories received truly representative aliquots. However, it appears evident that the sulfosalicylic acid "wet-chemical" method is fairly reproducible among different laboratories. The silver chloride spectrographic method appears to be poorly reproducible among different laboratories. At KAPL, the sulfosalicylic wet-chemical method and the a-c arc spectrographic method appear to be satisfactorily interchangeable. Until a more carefully and efficiently organized comparison is made, nothing can be said about reproducibility among laboratories of the four methods not checked in this manner. Nor can statements be made about bias (or accuracy) of any of the methods. (auth)

6254 NP-8252

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

QUANTITATIVE EVALUATION OF CHROMATOGRAMS BY DOUBLE DECOMPOSITION WITH SIMPLE RADIOACTIVE REAGENTS. I. THE USE OF $Ag^{131}I$ IN RADIOMETRIC ESTIMATION OF ORGANIC AND PHOSPHORIC ACIDS. Report No. 43/V;XRB. Z. J. Zubrzycki, A. Z. Budzyński, and I. G. Campbell. Nov. 1958. 13p.

A method was developed for the radiometric estimation of saturated fatty acids, inorganic phosphates and glucose-1-phosphate on paper chromatograms, by forming insoluble silver salts on the paper strip, followed by decomposition of the salt with I^{131}-iodide, and radiometry of the AgI^{131} deposit. Integrated activities of spots are linearly related to spot content. The maximal (peak) spot activity is proportional to the logarithm of spot content for fatty acids and phosphates, but not for glucose-1-phosphate. (auth)

6255 NP-8289

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

A GRAPHICAL DETERMINATION OF URANIUM AND THORIUM IN ORES FROM THEIR GAMMA-RAY SPECTRA. Research Report R 46. J. L. Horwood. Dec. 1959. 28p.

A graphical method is described for calculating the uranium and thorium contents of ores. The intersection of straight lines, each relating to a selected interval in the gamma-ray spectrum, makes possible a rapid estimate of the respective contribution of each series (uranium and thorium) to the total gamma activity. The departure from equilibrium in the uranium series and the effect of potassium are both considered. Spectrum curves were plotted for crushed ore samples. Count yields in a number of selected spectral intervals are given for natural uranium, natural thorium, purified uranium oxide (less radium and daughters), and potassium, to illustrate the construction of the linear equations. Typical solutions are shown for several types of ore samples. (auth)

6256 ORNL-2862

Oak Ridge National Lab., Tenn.

A STUDY OF SPECTROPHOTOMETRIC METHODS FOR THE DETERMINATION OF OSMIUM (thesis). G. Goldstein. Jan. 20, 1960. 76p. Contract W-7405-eng-26. OTS.

Submitted to the Univ. of Tennessee.

The development of rapid, selective, and sensitive methods for the determination of osmium in liquid samples is reported. The specific application of primary interest was the estimation of microgram or milligram quantities of osmium in homogeneous reactor fuel solutions which contain uranyl sulfate as the major component and corrosion products of stainless steel as minor components. (W.L.H.)

6257 SCS-R-135

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC ESTIMATION OF TRACES OF INDIUM IN URANIUM BY CONCENTRATION ON ALUMINA. J. E. Dunabin, A. P. Seyfang, and D. Trappe. 1959. Date of MS., July 18, 1950. 23p.

A spectrographic method is presented for determination of indium traces adsorbed as dithiozonate on activated alumina. The indium is recovered from citrate solution using cupferron in addition to dithizone. (J.R.D.)

6258 SCS-R-254

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

SPECTROGRAPHIC DETERMINATION OF ANTIMONY AND TIN IN BISMUTH OXIDE. E. Newman, A. P. Seyfang, G. Bacon, and J. Money. 1959. Date of MS., Jan. 8, 1952. 16p.

Antimony and tin are determined by an iron flux spectrographic procedure after co-precipitation on manganese dioxide from a sample solution. Recoveries in spiked samples were about 70% at the 20 ppm level. A lower determination limit of 6 ppm for each element was established. (J.R.D.)

6259 WCAP-6036

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. ANALYST PERFORMANCE ON SYNTHETIC PUREX SAMPLES. H. Ginsburg and C. C. Thomas, Jr. Jan. 15, 1960. 61p. Contract AT(30-1)-2176, Task I. OTS.

Results are presented on an evaluation of analyst performance and the reliability of certain analytical procedures employed in the Nuclear Materials Control System (NMCS) program. Synthetic samples pertinent to the NMCS Project were prepared and analyzed. The bias, standard deviation, and their associated 95% confidence limits are presented for each analyst for several series of determinations. A modified x ray fluorescence spectrometric pro-

cedure for the destructive assay of uranium in MTR and ETR fuel plates is discussed. Details on the analytical and statistical procedures employed in the NMCS studies are included. (auth)

6260 AEC-tr-3958

NITRITE TITRATION IN ORGANIC ANALYSIS. Miroslav Matrka. Translated for Los Alamos Scientific Lab. from Chemie (Prague) 10, 635-46(1958). 13p. JCL.

The available information on the history and present state of nitrate titration methods used in organic chemistry is presented. All methods discussed were tested experimentally. (W.L.H.)

6261 AEC-tr-3959

PAPER CHROMATOGRAPHY BY MEANS OF THE LINE FURNACE. Andras Biro. Translated for Los Alamos Scientific Lab. from Magyar Kem. Folyóirat 65, 245-9 (1959). 10p. JCL.

Investigations of a qualitative microanalytical chromatographic method which allows for the separation of components on the order of 10^{-6} to 10^{-7} g on a single strip of paper are reported. The sample is dropped on the paper and washed with a corresponding carrying solvent to the surface of the line furnace where the solvent evaporates and the sample remains in the form of a distinct straight line. The components can be separated with reagents in corresponding order into strictly distinguished lines. The reaction sensitivity is thus greatly increased. Model experiments are included. (J.R.D.)

6262 AEC-tr-3962

THE COULOMETRIC DETERMINATION OF OXYGEN IN STEEL BY THE MOLTEN-EXTRACTION TECHNIQUE IN A STREAM OF ARGON. Karl Abresch and Helmut Lemm. Translated by George J. Kamin (Ames Lab.) from Arch. Eisenhüttenw. 30, 1-6(1959). 27p. JCL.

The purpose of this research was to improve the carrier gas technique for the determination of oxygen in steel. The molten extraction technique for the determination of oxygen was altered so that the samples were no longer extracted in a vacuum, but rather in a stream of argon. The evolved carbon monoxide is converted to carbon dioxide by an oxidizing agent and then titrated coulometrically. The time of determination is 7 min. The applicability of this technique was checked through a series of analyses. It showed a standard deviation of 0.0012%. (W.L.H.)

6263

DETERMINATION OF TRITIUM IN BIOLOGICAL MATERIAL. H. I. Jacobson, G. N. Gupta, C. Fernandez, Sharon Hennix, and E. V. Jensen (Univ. of Chicago). Arch. Biochem. Biophys. 86, 89-93(1960) Jan.

A method is described by which tritium in blood and tissues may be determined conveniently on a routine basis. The procedure involves conversion of the tritium to water by combustion with copper and copper oxide in sealed tubes, collection of the tritiated water by vacuum distillation, and determination of the radioactivity in the water by liquid scintillation counting. (auth)

6264

USE OF OSCILLOGRAPHIC POLAROGRAPHY IN QUANTITATIVE ANALYSIS. X. DETERMINATION OF EUROPIUM IN PRESENCE OF OTHER RARE EARTHS. J. Doležal and K. Janáček (Institut für analytische Chemie, Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 3790-2(1959) Nov. (In German)

A description is given of the development of a method for determining Eu in a mixture of other rare earths using an oscillographic polarography technique. (T.R.H.)

6265

SPECTRAL METHOD OF DETERMINING THE ISOTOPIC COMPOSITION OF LEAD. PART I. A. N. Zajdel, A. G. Zhiglinski, and J. Čajko (State Univ., Leningrad). Czechoslov. J. Phys. 8, 530-43(1958). (In Russian)

An apparatus was developed for analyzing the isotopic composition of lead separated from geological samples. The light source was a water-cooled or liquid-air-cooled hollow cathode discharge tube. The high-resolution apparatus was a Fabry-Perot dielectric multilayer interferometer which was located in a pressure chamber and the scanning of isotope structure of the lead line PbI 4057.8 Å was realized by varying the pressure between the interferometer plates. The hyperfine structure of the spectral line was recorded by a photo-multiplier cooled by liquid air. The real resolving power of the apparatus was around 1,000,000. An analysis of the described apparatus enables us to consider all the causes of errors in the intensities of components of hyperfine structure of the spectral line. The result gives us the conditions for which these causes are either completely removed or their influence is negligibly small. In order to avoid deformation of the contours of the spectral line as a result of non-linear changes in the pressure between the interferometer plates, the recording of the hyperfine structure must be limited to the first five or six interference orders, beginning with the moment of letting air into the pressure chamber. An analysis of the time changes in the brightness of the light source and its dependence on the quantity of the tested sample and background intensity showed that analysis is best carried out for samples of 2 to 5 mg lead iodide. Before analyzing the sample must be annealed 10 to 20 minutes. A study of the dependence of the intensity of the spectral line on the pressure of argon in a hollow cathode discharge tube enabled determination of the optimum pressure, which was 0.3 mm Hg. By studying the self-absorption for various quantities of the tested sample as a function of the discharge current we came to the conclusion that in order to eliminate self-absorption for amounts of about 5 mg PbI_2 it is necessary to work at discharge currents of about 100 mA in the case of a water-cooled hollow cathode discharge tube and at the most 50 mA for a liquid-air-cooled hollow cathode discharge tube. (auth)

6266

PRACTICAL PERFORMANCE OF AN ACTIVATION ANALYSIS: CHLORINE DETERMINATION IN ZINC SULFIDE. I. F. Baumgärtner (Technische Hochschule, Munich). Kerntechnik 1, 137-9(1959) Nov. (In German)

Activation analysis is an investigation method of analytical chemistry. Its detection range is more than a power of ten lower than the usual microanalytical methods. It is therefore applicable to trace analysis. It is shown how such an analysis is carried out with simple chemical methods. The example used is the determination of chlorine in zinc sulfide. (tr-auth)

6267

PHYSICAL AND CHROMATOGRAPHICAL OBSERVATIONS OF γ-IRRADIATED POTATO STARCH GRANULES. Akira Mishina and Ziro Nikuni (Univ. of Osaka). Nature 184, Suppl. 24, 1867(1959) Dec. 12.

Small molecular fission products of an irradiated specimen of potato starch were analyzed by several chromatographical methods. Results indicate that ether bonds of the starch molecule are split into corresponding radicals which combine with H and OH radicals of crystallization or the starch molecule itself forming mono- and oligo-saccharides, with possibly sugar acids and a pentose formed from D-glucose. (C.H.)

6268
DETERMINATION OF TRITIUM IN A PROPORTIONAL COUNTER. W. G. Verly, G. Hunebelle, and G. Thomas (Université, Liège and Centre Belge de l'Energie Nucléaire [Liège]). Nukleonik 1, 325-9(1959) Dec. (In French)

A method for the determination of tritium in the form of hydrogen in a counter of the Bernstein-Ballentine type operating in the proportional zone is presented. The filling is completed with methane up to a pressure of 760 mm Hg. The partial pressure of the tritiated hydrogen can attain 500 mm. With one tube a voltage of 4500 V is used for the measurement on the condition that the hydrogen pressure does not exceed 50 mm and that the total pressure does not vary more than 10 mm from its optimum value of 760 mm. The background is 90 counts per minute. No contamination of the counter tube by tritiated hydrogen is observed. The counting yield is quantitative for disintegrations produced in the cathode cylinder. The error for the complete measurement (introduction of the sample into the tube and counting) is 2%. (tr-auth)

6269
DETERMINATION OF TRITIUM IN A PROPORTIONAL COUNTER. II. Preparation of Samples. P. A. Ciccarone, G. Thomas, and W. G. Verly (Université, Liège and Centre d'Etude de l'Énergie Nucléaire, Brussels). Nukleonik 1, 329-32(1959) Dec. (In French)

The tritiated organic compound is burned in an oxygen current, and the water of combustion is transferred under vacuum to a blank tube containing magnesium turnings. The tube is then sealed and heated to 550°C for 1 hr. The tritium in the hydrogen from the reduction is measured in a proportional counter in the presence of methane. Neither the combustion apparatus nor the magnesium turnings are sources of hydrogen or other gases, so that the measurement of the specific activity of the reduction hydrogen can be used to calculate the tritium concentration in the organic compounds. The memory effect in the combustion apparatus is negligible and the error in the complete apparatus is 1.5%, approximately. (tr-auth)

6270
ULTRASONIC WELDING OF DISSIMILAR-METAL COMBINATIONS FINDS GROWING APPLICATION IN STRUCTURAL, ELECTRICAL AND ELECTRONIC FIELDS. W. C. Potthoff, John G. Thomas, and Florence R. Meyer (Aeroprojects, Inc., West Chester, Penna.). Welding J. (N. Y.) 39, 131-8(1960) Feb.

A review is presented of ultrasonic welding techniques for joining dissimilar metals that are difficult or impracticable to join by conventional techniques. Applications to structural, electrical, and electronic fields are discussed. Ultrasonic bonds in bimetal combinations of high-temperature refractory metals and alloys such as molybdenum, titanium, zirconium, and precipitation-hardening stainless steels were produced and found to be of good structural integrity. (C.J.G.)

6271
INFLUENCE OF THIRD ELEMENTS IN SPARK SPECTROGRAPHIC ANALYSIS OF SOLUTIONS. A. K. Rusanov and L. I. Sosnovskaya (State Scientific Research and Design Inst. of Rare Metal Industry, Moscow). Zhur. Anal. Khim. 14, 643-57(1959) Nov.-Dec. (In Russian)

One of the main reasons for third elements influencing the intensity of the lines of the elements determined by spark spectrographic analysis of solutions is the alteration of the excitation conditions owing to the elements with low ionization potentials appearing in the solution. The influence of the elements is also connected with the conditions of introducing the solutions into the spark discharge. The influence of the elements is a minimum when the discharge takes place between the solution surfaces which are not broken down by the spark. It intensifies when processes on the electrodes take place during the introduction of solutions into the spark. The intensity of the lines of the solution spectrum, up to the moment of the spark break down of the film, decreases with the increase of the film thickness, and depends on the viscosity and conductivity of the solution and on the speed of the film renewal. (auth)

6272
RAPID PHOTOMETRIC DETERMINATION OF THE SUM OF RARE EARTHS. A. F. Kuteinikov and G. A. Lanskoi (All-Union Inst. of Mineral Raw Materials, Moscow). Zhur. Anal. Khim. 14, 686-90(1959) Nov.-Dec. (In Russian)

Compounds of rare earths and some other elements with arsenazo were investigated. Spectral characteristics of the solutions of these compounds were studied; molar extinction coefficients and equilibrium constants of the reactions of complex formation were found. It was established that the sensitivity of colorimetric reactions of rare earths with arsenazo, the stability of compounds formed, and their extinction spectra are interdependent. A method of preparing calibration curves for the determination of rare earths was suggested. The possibility of the quantitative colorimetric determination of the sum of rare earths in natural materials was established on the basis of the similarity of chemical and optical characteristics of the compounds of rare earths with arsenazo. A rapid method for the quantitative photocolorimetric determination of the sum of rare earths with arsenazo was suggested. (auth)

6273
QUANTITATIVE DETERMINATION OF YTTERBIUM IN THE PRESENCE OF LARGE QUANTITIES OF ERBIUM BY OSCILLOGRAPHIC POLAROGRAPHY. Ya. P. Gokhshtein and G. A. Kutyreva (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 14, 691-5(1959) Nov.-Dec. (In Russian)

The determination of ytterbium with an ordinary polarograph is not possible in the presence of erbium. A method is worked out for quantitatively determining Yb^{3+} in erbium samples by oscillographic polarography. When traces of ytterbium are determined, the sensitivity of the method is almost an order higher than that of the x-ray spectrographic analysis; the accuracy of the determinations is 11%. At concentrations of Yb^{3+} higher than 0.1%, the results obtained by both methods are in good agreement. (auth)

6274
ON THE PHOTOMETRIC DETERMINATION OF TIN. T. N. Nazarchuk (Inst. of General and Inorganic Chemistry, Academy of Sciences, Kiev). Zhur. Anal. Khim. 14, 696-9 (1959) Nov.-Dec. (In Russian)

Methods are worked out for the photometric determination of tin in metallic nickel of H-0 and H-1 grades, tungsten oxide, and bronze with the use of quercetin, stilbazo, and hematoxylin. The possibility is shown of using the above mentioned reagents for the determination of microamounts of tin. (auth)

6275
ON SPECTROCHEMICAL DETERMINATION OF NIOBIUM IN ROCKS. N. I. Tarasevich and K. A. Semenenko (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 705-9(1959) Nov.-Dec. (In Russian)

A method of chemical concentration of niobium based on the co-precipitation of niobium on silicic acid in the presence of gelatine and pyrogallic acid was suggested and tested experimentally. A spectrographic method for determining 0.1 to 0.0009% of niobium in the isolated silicic acid, with the use of home-made apparatus, was developed. Determination of niobium in gneisses and granites is possible at concentrations up to $n \times 10^{-5}$% with the error ~20%. (auth)

6276

GRAVIMETRIC AND TITRIMETRIC DETERMINATION OF BISMUTH WITH THE USE OF AMMONIUM SALTS OF BENZOL- AND NAPHTHALENE SELENONYL ACIDS. V. S. Sotnikov and I. P. Alimarin (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 14, 710-13(1959) Nov.-Dec. (In Russian)

Two new reagents—$C_6H_7SeO_2NH_4$ and $C_{10}H_7SeO_2NH_4$—for the gravimetric determination of bismuth are suggested. The reagents form with bismuth the white crystalline precipitates $Bi(C_6H_5SeO_2)_3$ and $Bi(C_{10}H_7SeO_2)_3$ in mineral acid solutions. Bismuth is weighed after drying the precipitates at 110 to 120°. The possibility is shown of the titrimetric determination of bismuth by solutions of $Bi(C_6H_5SeO_2)_3$ in a mixture of mineral and tartaric acids and iodimetric titration of $C_6H_5SeO_2H$ by the potentiometric or amperometric method. The relative error of the determination of 5 to 20 mg of Bi does not exceed 0.5%. (auth)

6277

ANALYTICAL APPLICATION OF 8-MERCAPTOQUINOLINE (THIOOXINE) AND ITS DERIVATIVES. COMMUNICATION 8. NEW PHOTOMETRIC METHOD FOR DETERMINING RHENIUM IN THE PRESENCE OF MOLYBDENUM, TUNGSTEN AND OTHER ELEMENTS. Yu. A. Bankovskiĭ, A. F. Ievin'a, and E. A. Luksha (Inst. of Chemistry, Academy of Sciences, Riga). Zhur. Anal. Khim. 14, 714-20 (1959) Nov.-Dec. (In Russian)

Thiooxine forms with rhenium innercomplex salts colored differently depending on the conditions. Very stable rhenium thiooxinate which is formed in 5 to 11.75 N HCl enables the determination of small amounts of rhenium by the photometric method. A very selective photometric method for determining Re (5 to 200 γ and more) in the presence 5000 times as much Mo, 500 times as much W, and predominant quantities of other elements is worked out. (auth)

6278

POTENTIOMETRIC DETERMINATION OF RHENIUM IN THE PRESENCE OF MOLYBDENUM. D. I. Ryabchikov, V. A. Zarinskiĭ, and I. I. Nazarenko (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 14, 737-8(1959) Nov.-Dec. (In Russian)

Perrhenate reduction with bivalent chromium salts in a sulfuric acid medium was studied with the use of a platinum indicator electrode. Conditions for the quantitative determination of rhenium in the presence of small amounts of molybdenum were established. (auth)

6279

LUMINESCENT DETERMINATION OF SMALL AMOUNTS OF ALUMINIUM IN METALLIC MAGNESIUM. A. F. Fioletova. Zhur. Anal. Khim. 14, 739-40(1959) Nov.-Dec. (In Russian)

The method for the fluorescent determination of aluminium in the chloroform extract of aluminium hydroxyquinolinate is suggested to use for the determination of aluminium in metallic magnesium. The accuracy of the determination of parts per thousand of aluminium is ±14%. Six hours are necessary for an analyst to carry out the analyses of two samples simultaneously. (auth)

6280

DETECTION OF ALUMINIUM IONS WITH 5-HYDROXY-1.4-NAPHTHOQUINONE. L. N. Aizenberg (Kishinev Agricultural Inst., [USSR]). Zhur. Anal. Khim. 14, 741-2(1959) Nov.-Dec. (In Russian)

A drop reaction for Al^{3+} by means of 5-hydroxy-1,4-naphthoquinone is described. The sensitivity and the limiting dilution of the reaction were determined. The influence of pH and some metal cations on the formation of a compound of aluminum with the reagent was studied. (auth)

6281

POLAROGRAPHIC STUDY OF TITANIUM AND NIOBIUM IN PYROPHOSPHORIC ACID SOLUTIONS. D. I. Kurbatov (Inst. of Chemistry, Ural Branch of the Academy of Sciences, Sverdlovsk, USSR). Zhur. Anal. Khim. 14, 743-4 (1959) Nov.-Dec. (In Russian)

Polarographic behavior of titanium and niobium in pyrophosphoric acid (sp. gr. 1.85) was studied. It was shown that titanium and niobium are reduced and give good polarograms separately, as well as when present together. The large difference in half-wave potentials of titanium and niobium and the direct proportionality of their concentration limiting currents allow their determination when present together up to the ratio Nb : Ti = 1 : 20. (auth)

6282

A DROP METHOD FOR DETERMINING MICRO-QUANTITIES OF BORON IN SILICON. A. L. Sokolova and V. A. Makharashvili. Zhur. Anal. Khim. 14, 745(1959) Nov.-Dec. (In Russian)

A simple method is developed for determining up to 10^{-6} g/g (10^{-4}%) of boron in silicon on filter paper by means of curcumine. (auth)

6283

ANALYSIS OF PENTABORANE. A. F. Zhigach, E. B. Kazakova, and R. A. Kigel. Zhur. Anal. Khim. 14, 746-7 (1959) Nov.-Dec. (In Russian)

A rapid and simple method for the analysis of pentaborane is based on its ability to react quantitatively with ethyl alcohol with the isolation of hydrogen and formation of $B(OC_2H_5)_3$; the latter is easily hydrolyzed with water to boric acid. (auth)

6284

ADVANCES IN MASS SPECTROMETRY. Proceedings of a Joint Conference Organised by the Hydrocarbon Research Group, Institute of Petroleum, and A.S.T.M. Committee E.14 and held in the University of London, 24th-26th September, 1958. J. D. Waldron, ed. New York, Pergamon Press, 1959. 716p. $18.00.

The performances of large single-focusing and double-focusing mass spectrometers and a stigmatic focusing mass spectrograph are reported. The correction of image defects in mass spectrometers and mass spectrographs and second-order aberration corrections in inhomogeneous magnetic sector fields are described. The applications of mass spectrometry to isotope dilution analysis, the study of copper and silver ionization in a triple-filament ion source, impurity determination in solids by a spark source, non-conducting solids analysis, analysis of trace quantities of rare gases, and the study of surfaces by sputtering are described. The time variation of alkali ion emission from solids on glowing metal surfaces is investigated. The applications of mass spectrometry in organic chemistry which are discussed include: heavy-oil analysis, corrosive gases analysis, organic impurities identification,

ion dissociation and ion-molecule reactions, and analysis of liquid products from coal hydrogenation. Digitization of mass spectra and the interpretation of mass spectra of organic materials, molecules, and phosphates and polyatomic molecules are discussed. The instrumental techniques used in the time-of-flight and high-speed cycloidal mass spectrometers are given. Electron impact studies on simple molecules, alkyl and halogenated alkyl free radicals, hydrazine and methyl-substituted hydrazines, and multiple ionization in helium and xenon are discussed. The kinetic energy of formation and electric breakdown in halogenated gases are considered. (C.J.G.)

Radiation Chemistry

6285 JLI-650-3-5

Johnston (William H.) Labs., Inc., Lafayette, Ind.

FUNDAMENTAL CONSIDERATIONS OF RADIATION TECHNOLOGY. M. B. Wallenstein, H. M. Rosenstock, and W. H. Johnston. Feb. 1959. Second Edition–Apr. 1959. 59p. Contract AT(11-1)-650.

The report begins with a section, "The Role of Radiation in Radiation Chemistry," which briefly discusses radiation chemistry, deals with a comparison of isotopes, reactors, and machines, and treats the concept of the G value or energy utilization. It emphasizes the approach to improved G values for which little careful attention has been given in this country. The second section is, "Economic Considerations." This section could be subtitled "Operations Research in Radiation Technology." It analyzes the important extra-scientific parameters such as cost per kilowatt hour for radiation energy, amount of material that can be produced per unit time, comparative basic costs by conventional processes, projected consumption of products, radiation source levels, production G values, etc. These factors and others set immediate boundary conditions which define the area in which to seek commercial applications of high level radiation. The third section is entitled, "Potential Immediate Industrial Applications." These specific examples are important in their own right and also illustrate the way in which our present understanding of radiation chemistry can be used as a guide to a coherent and directed search for applications. These examples include a number of products in the specialty chemical field as well as some in the area of "heavy" chemicals. The examples are deliberately chosen to span a wide range of potential applications of high level radiation. The fourth section, "Basic Research Programs," summarizes the vectored researches which should be encouraged and supported to sharpen the approach to economically attractive industrial radiation technology. In this section, Excited State Chemistry is emphasized. A subsequent fully technical report will expand and detail these proposed vectored researches. Finally, a section "Radiation Technology in Russia," outlines the progress and emphasizes that work in Russia is more directly vectored toward developing industrial radiation processes. An appendix is included entitled "Review of Fundamentals." This appendix summarizes the definition and terms used throughout the report and constitutes a useful review of concepts. (auth)

6286

VARIATION OF THE OPTICAL PROPERTIES OF BENZENE IN RESPONSE TO GAMMA RAYS. S. V. Starodubtzev, M. N. Gurskii, and A. G. Sizykh. Doklady Akad. Nauk S.S.S.R. 129, 307-9(1959) Nov. 11. (In Russian)

Light scattering, luminescence, polarization plane rotation, diffraction index, and molecular spectra of pure benzene are studied in order to observe the accumulation of transmutation products in irradiated material. It is shown that γ rays induce changes in optical properties which reflect the dynamics of radiolysis processes. The optical methods used proved sensitive to dose variations of the order of 0.6×10^6 r. The method of scattered light revealed changes in the character of heterogeneities and their development with increased dose. The irradiated benzene luminescence shifts into the visual range. The wide luminescence spectrum continuum obviously represents the superposition of spectra of several radiolysis products which tend to polarization. (R.V.J.)

6287

THE EFFECT OF γ-RADIATION ON THE RATE OF HYDROGEN EXCHANGE BETWEEN WATER AND ISOAMYLTHIOL. K. I. Sakodynskii and N. M. Zhavoronkov (Karpov Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 129, 391-3(1959) Nov. 11. (In Russian)

The effects of γ radiation on H exchange between water and isoamylthiol in heterogeneous liquid-liquid systems were studied with up to 3 to 5% deuterium enriched water (1 g) and amylthiol (4 to 5 g). The obtained data indicate an acceleration of isotopic exchange as the result of irradiation. (R.V.J.)

6288

THE CHEMICAL ACTION OF IONIZING RADIATIONS IN SOLUTION. PART XXIII. THE ACTION OF Co^{60}–GAMMA-RAYS ON AQUEOUS SOLUTIONS OF ETHANOL IN THE LIQUID AND THE FROZEN STATE. J. T. Allan, E. M. Hayon, and J. Weiss (King's Coll., Newcastle Upon Tyne, Eng.). J. Chem. Soc., 3913-19(1959) Dec.

The action of Co^{60}-gamma rays on deaerated aqueous solutions of ethanol at different concentrations (from 10^{-3}–5M) was studied in the liquid and in the frozen state from 20 to –196°C. The products were acetaldehyde, butane-2,3-diol, hydrogen peroxide, and molecular hydrogen. The dependence of the yields of these products on solute concentration, physical state, and temperature was investigated. A mechanism was put forward to account for the experimental results, with particular reference to the reactions in the frozen solutions. (auth)

6289

RADIOCHEMICAL INVESTIGATION ON URANIUM. II. OXIDATION OF URANIUM SULFATE BY α RAYS; EFFECT OF HIGH URANIUM CONCENTRATION AND OF THE NATURE OF THE ANION. M. Haissinsky and M. Duflo (Laboratoire Curie, Paris). J. chim. phys. 56, 955-66(1959) Nov.-Dec. (In French)

The oxidation yield of uranous sulfate (U^{4+}) in acid solution by polonium α rays in the absence of air decreases at first with the increase of concentration and then remains constant. It is confirmed that the presence of hexavalent uranium in high concentration also causes a decrease in the oxidation yield of U^{4+} by γ rays, but this effect was not observed with α rays. This is in agreement with the hypothesis formulated by Russian writers on the transitory reduction of UO_2^{2+} by H atoms. The irradiation of uranous sulfate by α rays in the presence of air gives very high oxidation yields, lower however, than those obtained with γ rays. The oxidation yields with α rays vary with the intensity according to a $I^{-\frac{1}{2}}$ law. This leads to a reaction mechanism essentially analogous to that which has been proposed for chain reaction propagated by electron transfer between UO_2^{2+} and O_2. To this mechanism is

added the oxidation of U^{4+} by H_2O_2 and its reduction by the electrons in the α trajectories, followed by the reoxidation of U^{3+} by oxygen. U^- ions are oxidation inhibitors of the U^{4+} both in the presence and absence of air. Oxidation in perchloric solution is complicated by the superposition of oxidation reactions by the products from the direct effect of radiation on UO_4^- with radical reactions. (tr-auth)

6290

STUDY OF IONS PRODUCED BY ELECTRON COLLISION IN WATER VAPOR. Maurice Cottin (Laboratoire Curie, Paris). J. chim. phys. 56, 1024-35(1959) Nov.-Dec. (In French)

The ions produced in water vapor by electron bombardment were studied with the aid of a mass spectrometer. The ions H_2O^+, H_3O^+, OH^+, O^+, H^+, H^-, O^-, and OH^- were observed. The study of difference appearance potentials permitted a determination of the reactions responsible for the formation of these ions. (tr-auth)

6291

SCAVENGER STUDIES IN THE γ-RADIOLYSIS OF HYDROCARBON GASES AT VERY LOW CONVERSIONS. R. A. Back (McGill Univ., Montreal). J. Phys. Chem. 64, 124-7 (1960) Jan.

Experiments at very low conversions, using ethylene or propylene as scavengers for hydrogen atoms, indicate that about two-thirds of the hydrogen produced in the γ-radiolysis of ethane, propane, n-butane, and n-pentane, in the gas phase, arises from hydrogen atoms. This is considerably higher than indicated from previous studies at higher conversions, and it is suggested that unsaturates produced in the radiolysis acted as internal scavengers in the latter systems, thus reducing the apparent yield of "radical" hydrogen. Kinetic evidence is presented indicating that the unsaturates used as scavengers in the present work removed hydrogen atoms by a simple addition reaction and did not interfere in other stages of the radiolysis. (auth)

6292

ESTIMATION OF CHAIN FRACTURE AND CROSS-LINKING OF RUBBER BY HIGH-ENERGY RADIATION. P. Hayden (Atomic Energy Research Establishment, Wantage, Berks, Eng.). Nature 184, Suppl. 24, 1865-6(1959) Dec. 12.

Lightly masticated pale crepe rubber, which had been freshly extracted with acetone, was evacuated and sealed in glass tubes. After gamma irradiation from a cobalt-60 source or a linear electron accelerator, the soluble fraction was measured by extraction of the samples with benzene. In each case the mean intensity of the radiation was estimated by ferrous sulfate dosimetry. Solubility data for the gamma irradiation of rubber at two dose rates at 25°C were quantitatively analyzed by the method of Charlesby and Pinner. Results show that the rate of cross-linking is directly proportional to the intensity of radiation. Results indicate that the initial distribution of molecular weights is not perfectly random and some dislinking is necessary to obtain the results. The ratio of the rate of dislinking to cross-linking was calculated. Infrared spectroscopic analysis revealed a marked increase in the absorption near 1,639 cm^{-1}, identified as terminal unsaturation, which was presumed to arise from the dislinking reaction. There was also evidence of trans-vinylene unsaturation during irradiation. (C.H.)

6293

CHEMICAL DOSIMETRY WITH FLUORESCENT COMPOUNDS: THE DESTRUCTION OF THE FLUORESCENCE OF QUININE BY GAMMA RAYS. Nathaniel F. Barr and Mary B. Stark (Sloan-Kettering Inst. for Cancer Research, New York). Radiation Research 12, 1-4(1960) Jan.

The fluorescence of quinine in 0.8 N H_2SO_4 is destroyed on the absorption of ionizing radiation. Maximum initial G values of 2.3 are obtained for initial quinine sulfate concentrations greater than 1 ppm. Measurement of the fluorescence of quinine solutions containing initial concentrations of quinine sulfate between 0.1 ppm and 1 ppm provide a convenient and reproducible method of determining absorbed doses between 10 and 1000 rads. (auth)

Radiochemistry

6294 AERE-R-3010

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CONCENTRATION BY ELECTRODIALYSIS OF CAESIUM AND STRONTIUM RADIOACTIVITIES IN WATERS. M. J. Owers. Nov. 1959. 12p. BIS.

The concentration of low-level cesium and strontium radioactivities from aqueous solutions was achieved by electrodialysis and concentration factors of one hundred were obtained. The application of this method to the radiochemical analysis of tapwaters is described. (auth)

6295 MLM-443-3

Mound Lab., Miamisburg, Ohio.

GENERAL RESEARCH QUARTERLY REPORT FOR JANUARY, FEBRUARY, MARCH 1950. Apr. 1, 1950. Decl. Nov. 24, 1959. 27p. Contract AT-33-3-GEN-53. OTS.

As a stand in for the Ac–Ra separation, an ion exchange technique was demonstrated for the separation of Ba and La. The volatilization of LaI_3 is described. Preliminary calculations are graphically presented for the radiometric analysis of Ac^{227} (13.5 yr). (C.W.H.)

6296 MLM-499

Mound Lab., Miamisburg, Ohio.

GENERAL RESEARCH REPORT FOR JUNE 26 TO SEPTEMBER 18, 1950. (Actinium Volume). Oct. 23, 1950. Decl. Nov. 24, 1959. 16p. Contract AT-33-1-gen-53. OTS.

Procedures are outlined for the separation of Ac^{228} from Ra^{228} in aged $Th(NO_3)_4$ solutions and for the preparation of Ac^{228} samples. (C.W.H.)

6297 MLM-557

Mound Lab., Miamisburg, Ohio.

REPORT FOR GENERAL RESEARCH [FOR] DECEMBER 11, 1950 TO APRIL 2, 1951. (Radium Volume). May 7, 1951. Decl. Nov. 24, 1959. 76p. Contract AT-33-1-GEN-53. OTS.

The work presented in this volume concludes the research on methods for the recovery of purified radium from K-65 residues. The completion of a final report and an engineering study of the proposed process are underway. The preliminary treatment of the K-65 residues with 15% sodium hydroxide was checked and found to give 84% removal of lead and 40% removal of silica. The combined sodium hydroxide, sodium carbonate treatment for removing additional amounts of lead and achieving a preliminary conversion of the radium-barium sulfates to carbonates has been studied at 170°C under pressure as well as at 100°C as previously used. A marked improvement was found with the use of higher temperatures. Alternate methods were studied for removing the residual lead content in place of precipitation with hydrogen sulfide. Precipitation of insoluble hydroxides was found to remove about 90% of the lead present. The over-all recovery of radium in the residues treatment has been checked and found to be better than 98%. The work on the separation of radium from

barium by fractional precipitation of the chromates has shown that in actual practices the results are in good agreement with the results calculated from the observed enrichment factors. The fractionation schemes have been worked out for the use of cyanide at 0 and 25°C and urea at 100°C. Additional measurements have been made on the solubility of barium chromate in nitric acid to determine the barium concentrations which can be handled in the fractional precipitation of the barium-radium chromates. The use of ion exchange for the separation of radium from barium appears to be most useful for the final purification of the radium. Additional experiments were directed toward increasing the amount of radium to the milligram level and toward determining, by extrapolation, the amount of barium in the radium fractions below the level which can be detected analytically. It has been found that the liquid wastes from the radium process can be effectively decontaminated by neutralization under the proper conditions. The decontamination obtained results largely from the precipitation of the lead sulfate which occurs when the solutions are neutralized. Additional experiments have shown ferrous sulfide to be the most suitable precipitating agent found for a second decontamination step rather than the ferrous ferrocyanide previously suggested. Experiments have shown that the major portion of the nitric acid used for the conversion of the barium-radium chromates to nitrates can be recovered by distillation for reuse. (auth)

6298 MLM-558(Del. 1)
Mound Lab., Miamisburg, Ohio.
REPORT FOR GENERAL RESEARCH [FOR] DECEMBER 11, 1950 TO APRIL 2, 1951. (Actinium Volume). May 7, 1951. Decl. Nov. 24, 1959. 83p. Contract AT-33-1-GEN-53. OTS.

Studies were continued on processes for the separation and purification of Ac^{227} from neutron-irradiated Ra and for the deposition of Ac on various metal surfaces. (For preceding period see MLM-519.) (C.W.H.)

6299 MLM-622(Del. 1)
Mound Lab., Miamisburg, Ohio.
REPORT FOR RESEARCH ON SUBSTITUTE MATERIALS [FOR] JULY 2, 1951 TO OCTOBER 1, 1951. (Actinium-227). Nov. 5, 1951. Decl. Nov. 24, 1959. 47p. Contract AT-33-1-GEN-53. OTS.

Brief reports on various phases of development of the process for Ac^{227} production are given. Evaporation of highly active $Ba(NO_3)_2$ in HNO_3 solutions, determination of Ra purity, Ra determination by α counting, reduction of $LaBr_3$ with Ca metal, preparation of lanthanum acetylacetonate and lanthanum amide, and high-temperature volatilization of metal are the subjects reported on. (T.R.H.)

6300 MLM-773(Rev.)
Mound Lab., Miamisburg, Ohio.
TENTATIVE PROCEDURE FOR THE ANALYSIS OF MIXTURES CONTAINING RADIUM-226, ACTINIUM-227, AND THORIUM-228. H. W. Kirby. Oct. 15, 1952. Decl. Nov. 24, 1959. 9p. Contract AT-33-1-gen-53. OTS.

Procedures are outlined for the analysis of waste solutions obtained in the recovery of Ac^{227} from irradiated Ra^{226}. Ra^{224} is determined by precipitating $Ra(NO_3)_2$–$Ba(NO_3)_2$ from 80% BNO_3 and determining the Ra^{226} in the precipitate by a differential decay technique; the filtrate is analyzed for Ac^{227} by precipitating the Th isotopes as iodates with added Th^{232} carrier and the residual Ra as nitrate. (C.W.H.)

6301 NAA-SR-Memo-2928
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DETERMINATION OF THE RELATIVE AMOUNTS S^{35}, P^{32}, AND Fe^{59} IN HIGH BOILING RESIDUE SAMPLES TAKEN FROM THE OMRE COOLANT. D. C. Lawrence. Oct. 20, 1958. 4p. OTS.

Measurements to determine the relative amounts of S^{35}, Fe^{59}, and P^{32} in OMRE high boiler residues in samples from barrels 1 through 43 were made. The average P^{32} activity was 2×10^6 dpm/g; that of S^{35}, 2×10^5 dpm/g; and that of Fe^{59}, 5×10^4 dpm/g. (J.R.D.)

6302 AEC-tr-3947
STUDY ON THE SEPARATION OF FISSION PRODUCTS. PREPARATION OF RADIOACTIVE CESIUM WITHOUT ENTRAINING AGENT. T. Siokawa and M. Yagi. Translated from Bunseki Kagaku 5, 220-1(1956). 7p. (JPRS-R-208-N). JCL.

A translation of this report in the French, issued as CEA-tr-X-67.

This paper was previously abstracted from the French translation and appears in NSA, Vol. 13, as abstract No. 4530.

6303 AEC-tr-3952
PROBLEMS OF DECONTAMINATION. (Problemes de Decontamination). J. Pomarola. Translated for Oak Ridge National Lab. from a publication of the French Atomic Energy Commission, 1959. 16p. JCL.

Procedures are presented for the protection of personnel in a radiochemical laboratory. Methods of decontamination are also discussed. (C.H.)

6304 CEA-tr-R-738
ADSORPTION DES RADIOÉLÉMENTS PAR ÉCHANGE D'IONS. (Adsorption of Radioelements by Ion Exchange). B. P. Nikolskii (Nikolsky). Translated into French from Zhur. Neorg. Khim. 3, 59-65(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13847.

6305 CEA-tr-R-745
SÉPARATION DES RADIOISOTOPES SANS ENTRAINEURS. (Separation of Carrier-Free Radioisotopes). N. P. Rudenko. Translated into French from Zhur. Neorg. Khim. 3, 167-74(1958). 27p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13839.

6306
EFFECTS OF PRELIMINARY IRRADIATION ON THE RATE OF THERMAL DISINTEGRATION OF SILVER OXALATE WITH Cd ADMIXTURE. V. V. Bol'dyrev, Yu. A. Zakharov, V. I. Eroshkin, and M. G. Sokolova (Kirov Tomsk Polytechnical Inst.). Doklady Akad. Nauk S.S.S.R. 129, 365-7(1959) Nov. 11. (In Russian)

The effects of ultraviolet light and Co^{60} γ radiation on the rate of thermal disintegration of silver oxalate with 5 mole % Cd admixture were investigated. (R.V.J.)

6307
REMOVAL AND RECOVERY OF CESIUM-137 FROM SWIMMING POOL REACTOR WATER. Fausto W. Lima, Alcídio Abrão, and Constância Pagano (Instituto de Energia Atômica, São Paulo, Brazil). Ind. Eng. Chem. 52, 147-8 (1960) Feb.

A process for recovering cesium-137 from the water-purification system of a swimming pool reactor is based on the co-crystallization of cesium-137 alum with ammonium alum in aqueous effluents from a mixed-bed ion exchange. The use of an ethyl alcohol medium and a crystallization temperature of 25°C enabled recovery of 98 to 100% of the cesium with one precipitation.

6308

ON THE KINETICS OF THE EXCHANGE OF RADIOACTIVE HYDROGEN BETWEEN HYPOPHOSPHOROUS ACID AND WATER. THE MECHANISM OF THE OXIDATION OF HYPOPHOSPHOROUS ACID. W. A. Jenkins and D. M. Yost (California Inst. of Tech., Pasadena). J. Inorg. & Nuclear Chem. 11, 297-308(1959) Dec.

The rate of exchange of tritium between tritiated water and hypophosphorous acid was studied. It was found that the rate law for this reaction can be expressed as $R = (H_3PO_2) \sum_a k_a(HA)_a$, where $\sum_a k_a(HA)_a$ represents summation over all the Brönsted acids in the system. This rate law is identical with the rate law for the oxidation of hypophosphorous acid by a variety of oxidizing agents, and it is therefore suggested that the exchange and oxidation reactions take place by similar mechanisms. These mechanisms involve two tautomeric forms of hypophosphorous acid in aqueous solution. (auth)

6309

HOT ATOM CHEMISTRY OF PHOSPHORUS. CHEMICAL IDENTITY OF RADIOPHOSPHORUS ORIGINATING FROM NEUTRON BOMBARDMENTS OF INORGANIC COMPOUNDS OF SULPHUR AND CHLORINE. Louis Lindner. Thesis, Universiteit, Amsterdam. 114p.

The distribution of radiophosphorus among its various possible oxidation states when produced by the reactions $S^{32}(n,p)P^{32}$ and $Cl^{35}(n,\alpha)P^{32}$ with fast neutrons and by the reaction $S^{32}(n,p)P^{33}$ with thermal neutrons was investigated in inorganic sulfur and chlorine compounds. The recoil energies imparted to the phosphorus particles by the reactions varied from tens to hundreds of kev. The influence of surrounding medium, neutron energy (recoil energy), temperature, and solvent medium on the radiophosphorus distribution is discussed. (C.J.G.)

Raw Materials and Feed Materials

6310 MCW-142

Mallinckrodt Chemical Works, St. Louis.

REDUCTION OF URANIUM TRIOXIDE TO URANIUM DIOXIDE WITH HYDROGEN—REACTION RATES AT VARIOUS TEMPERATURES. Carl W. Kuhlman, Jr. Oct. 12, 1948. Decl. Nov. 23, 1959. 6p. OTS.

The rates of the reaction $UO_3 + H_2 \rightarrow UO_2 + H_2O$ were measured at five temperatures from 400 to 500°C. The apparatus used to measure the reaction rate was described in report MCW-100. A velocity constant defined as $-dF/dt = kF$ (F = fraction unreduced UO_3) was fitted to the Arrhenium relationship. An apparent activation energy of 35,000 calories was also measured for the reaction. (auth)

6311 MCW-1379

Mallinckrodt Chemical Works, St. Louis.

PRODUCTION OF IONIUM FROM A PITCHBLENDE RESIDUE. C. W. Kuhlman, W. S. Knecht, and R. D. Piper. July 28, 1955. Decl. Nov. 23, 1959. 28p. OTS.

A plant designed for concentrating thorium by extraction from pitchblende residue by use of tributyl phosphate followed by hydrofluoric acid strip is described. The fluoride product is further purified by a solvent extraction flowsheet in hot laboratory equipment. An outline of the chemical technology used in this process is presented. (J.R.D.)

6312 NP-8220

Eldorado Mining and Refining Ltd. Research and Development Div., Ottawa.

RESEARCH AND DEVELOPMENT REPORT FOR NOVEMBER 1959. 44p. (R-59-11).

New Process Development. In chlorination tests on Beaverlodge mill feed at 500°C, U volatilizations were 8[illegible] and 93% at two and six hour retention times, respectively. Various stripping systems are being examined for production of nuclear grade product by solvent extraction. Tests were continued in the amalgam reduction program to reduce V contamination from Beaverlodge solution. Retention time and the concentration of potassium ions have been shown to be important factors in the precipitation of uranous sulfate from electrolytically reduced solutions. Process Development. Further filter leaf test data are reported in the use of Jaguar 507 in the filtration of carbonate leach pulp. Ninety-seven per cent extraction of U was obtained by leaching MgF_2 slag for four hours at 100°C with a sodium chlorate–ferric nitrate solution. Tests are in progress to investigate precipitation of ammonium diuranate from uranyl nitrate solution by urea. (For preceding period see NP-8069.) (W.L.H.)

6313 NP-8290

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

FLOTATION OF URANIUM ORES FROM THE ELLIOT LAKE AREA, ONTARIO. Technical Bulletin TB 2. W. R. Honeywell. Sept. 1959. 10p.

The method and results of a series of flotation tests on several Elliot Lake uranium ores are given. The reagents used were NaOH and Na_2SiO_3 in a desliming step, and tall oil fatty acid, Acintol FA-1 or FA-2, was used as collector. The average recovery obtained was 92% in about 5% of the weight. The leach feed was up-graded from 0.1 to about 0.2% U_3O_8. The cost of the flotation reagents would be 25 to 30 cents per ton. A saving of about 20 cents per lb of uranium would be effected. (auth)

6314 SRS-105

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

A REPORT ON WORK CARRIED OUT TO IMPROVE PRECIPITATION EFFICIENCIES IN THE CRUDE OXIDE EXTRACTION PLANT. G. W. Llewelyn. 1959. Date of MS. Dec. 1, 1954. 11p.

The conditions of precipitation of uranium peroxide, from various sources, in the crude ore extraction plant have been revised with a view toward increase of reaction efficiency and improvement of the quality of the product. It has been found possible to reduce the usage of hydrogen peroxide on the extraction liquor batches and on X-batches with no accompanying loss of over-all efficiency, and the effect of other conditions, e.g., SO_4/U ratio, concentration, temperature, nature of coagulating agent used, etc., has also been studied on these batches. Addition of sulfuric acid to the R liquor before precipitation induces a vast improvement in the state of the uranium peroxide product. The excessive consumption of hydrogen peroxide on F batches and the general low reaction efficiency here has been analyzed. (auth)

6315

THE REDUCTION OF HIGH SURFACE AREA URANIUM TRIOXIDE. R. E. DeMarco and M. G. Mendel (National Lead Co. of Ohio, Cincinnati). J. Phys. Chem. 64, 132-3 (1960) Jan.

The hydrogen reduction of high surface area, x-ray amorphous, UO_3 was studied at temperatures of 300 to 400°C and at hydrogen partial pressures of 0.25 to 1 atmos. The reduction was found to consist of two consecutive steps associated with the reactions: $UO_3 + H_2 \rightarrow UO_{2.56}$ and $UO_{2.56} + H_2 \rightarrow UO_2$. The linear weight loss-reaction time

curves indicated that both reactions are primarily controlled by adsorption of hydrogen on the product oxide surface. Activation energies of 27 and 39 kcal/mole were calculated for the reduction of UO_3 and of $UO_{2.58}$. (auth)

6316

CYCLIC PROCESSES OF PRODUCING UCl_6. (to United Kingdom Atomic Energy Authority). British Patent 818,321. Aug. 12, 1959.

A process for producing UCl_6 by decomposing UCl_5 into UCl_4 and UCl_6 and recycling the UCl_4 by conversion to UCl_5 is described. The UCl_5 is decomposed in a molecular still which removes the more volatile UCl_6. The UCl_4 is reacted with dry O_2 to form UO_2Cl_2 which is reacted in an autoclave to produce UCl_5. (T.R.H.)

Separation Processes

6317 AECU-4591

Ionics, Inc., Cambridge, Mass.

PROGRESS REPORT FOR PERIOD COVERING DECEMBER 17, 1959—JANUARY 15, 1960. Jan. 15, 1960. 4p. OTS.

The preparation of synthetic Th solutions of various concentration in 0.1 M H_2SO_4 is described. The precipitation of Th from these synthetic solutions by various reagents was investigated. (W.L.H.)

6318 BLG-38

Brussels. Centre d'Étude de l'Énergie Nucléaire.

PROCEDE DE RETRAITEMENT DE L'URANIUM IRRADIE PAR SUBLIMATION DES CHLORURES. (Procedure for the Reprocessing of Irradiated Uranium by Chloride Sublimation). Ph. Speeckaert. July 13, 1959. 24p.

A new method for reprocessing uranium by chlorination is described. The method is based on the difference of the vapor pressures of the uranium chlorides and the fission product chlorides. By fractional sublimation, a decontamination factor for β activity of about 100 can be obtained. The residual activity is due to zirconium and niobium. (auth)

6319 CF-59-11-26

Oak Ridge National Lab., Tenn.

TERMINAL REPORT—DESIGN OF A DAREX DISSOLUTION FACILITY IN ORNL BLDG. 3019 FOR ENRICHED POWER REACTOR FUEL ELEMENTS. Roy C. Robertson. Nov. 30, 1959. 101p. OTS.

The design drawings and specifications for a Darex pilot plant to be constructed at ORNL were about 75% complete when the project was terminated in September 1959. As a feed preparation step, this plant was designed to dissolve enriched, stainless-steel-clad, power reactor fuel elements in dilute aqua regia. The pilot plant design included a dissolver column, evaporator, clarifier, scrubbers, storage vessels, and condensers, for a total of about 31 major pieces of equipment, of which about 16 were to be constructed of titanium and most of the remainder of Type 304L stainless steel. These were arranged into nine units inside the cell and in three major service areas outside the cell. The unitized concept for arrangement of the cell equipment reduced the required number of high-grade field welds significantly. About 50 drawings were essentially completed and five specifications were written. This terminal report emphasizes the phases of the mechanical design having general application to other Darex facilities. (auth)

6320 HW-61076

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PROJECT CGC-830, PLANT MODIFICATIONS FOR REPROCESSING NON-PRODUCTION REACTOR FUELS. DESIGN CRITERIA FOR BUILDING 213-U CASK TRANSFER FACILITY. M. E. Yates. July 15, 1959. 9p. OTS.

A cask transfer facility for receiving common-carrier rail cars containing casks loaded with spent fuel elements and transferring these casks to captive cars for unloading is described. After unloading by remote control, the casks are decontaminated and returned to the common carrier. The facility design includes an area for final decontamination, and a storage area for casks and special tools. (J.R.D.)

6321 NAA-SR-4612

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GASEOUS CHEMICAL TREATMENT OF IRRADIATED URANIUM DIOXIDE. J. Guon and F. D. Rosen. Jan. 15, 1960. 24p. Contract AT-11-1-GEN-8. OTS.

Alternate oxidation and reduction treatments of tracer level irradiated uranium oxide, at 600 to 1250°C, removes most of the cesium, ruthenium, and tellurium. Over 99% of the ruthenium released was either adsorbed on the furnace tube or trapped on in-furnace filters. The release of gaseous activity, probably krypton, occurred instantaneously each time the treatment gas was admitted. The amount of gaseous activity decreased with successive treatments and was greater during oxidation than during reduction. The weight loss of oxide was insignificant. The treatment of uranium dioxide with hydrogen chloride at 1300 and 1400°C reduced the gross activity of the oxide by a factor of two and removed over 90% of the fission product ruthenium, cesium, and tellurium. The weight loss of oxide at 1300°C was low. (auth)

6322 NP-8239

Massachusetts Inst. of Tech., Cambridge.

URANIUM EXTRACTION IN USSR; AN ORGANIZED REVIEW OF THE PUBLISHED SOVIET LITERATURE FOR 1930–1958. A. M. Gaudin and L. T. Romankiw. Apr. 30, 1959. 78p.

Included in the survey were the following topics: physical and physicochemical concentration methods; chemical concentration methods; properties of uraniferous solutions; and methods of analysis for U. (W.L.H.)

6323 TID-7583

Division of Production, AEC.

PROCEEDINGS OF THE AEC SYMPOSIUM FOR CHEMICAL PROCESSING OF IRRADIATED FUELS FROM POWER, TEST, AND RESEARCH REACTORS, RICHLAND, WASHINGTON, OCTOBER 20 AND 21, 1959. Jan. 1960. 458p. OTS.

A review is presented in this symposium of the technology currently available for processing spent fuels from research, test, and power reactors. Twenty-one papers are included. Separate abstracts have been prepared for each paper. (W.L.H.)

6324 TID-7583(p.17-25)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

MANAGEMENT CONSIDERATIONS RELATIVE TO HANFORD. V. R. Cooper. 9p.

A plan for Hanford Works participation in the Atomic Energy Commission's interim chemical processing arrangement for power, test and research reactor fuels, has been designed. It follows five principal guidelines or considerations. From these considerations it was determined that a scheme utilizing a currently retired obsolete wartime facility could be modified and employed for the receiving, storage and feed preparation operations. The currently op-

erating Redox plant can be incorporated into the plan to accomplish the decontamination and separation of uranium and plutonium for return to the nuclear materials cycle. The resultant system can accommodate uranium and plutonium bearing fuels enriched to a maximum of five per cent U^{235} or equivalent composed of metallic or ceramic cores; clad with Zircaloy, stainless steel or aluminum. The manifold direct and supporting functions can be provided with minor exceptions from the present Hanford organization. The facilities will be ready to receive fuels in January 1961 and to begin chemical processing one year later. Actual processing schedules will be developed around a campaign basis to yield maximum utilization of processing facilities and minimum isotopic degradation of the recovered uranium. Engineering cost information will be obtained during the course of the program to provide industry with some of the information needed for appraising the possibilities of a private capital venture. The assignment of responsibilities regarding processing, engineering and operation are briefly considered. (auth)

6325 TID-7583(p.26-40)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RECEIVING, STORAGE, AND MECHANICAL TREATMENT OPERATIONS AT HANFORD FOR CHEMICAL PROCESSING OF POWER REACTOR FUELS. L. L. Zahn, Jr. 15p.

Plans at Hanford for its cask receiving and unloading, fuel element storage, and mechanical processing functions under the Non-Production Fuels Processing Program are outlined in this paper. These operations will be performed, along with dissolution and metal solution storage, in Hanford's 221-U Building built originally for the now-obsolete bismuth-phosphate separations process. The one new building planned for Hanford under this program will house a crane to transfer the shipping cask to a Hanford railcar for admittance to the 221-U Building, thereby protecting the cross-country car or truck from accidental contamination. The cask unloading and fuel element storage provisions within the 221-U Building are described in the paper Mechanical equipment is planned to complement Hanford's fundamental approach to decladding of fuel elements by chemical means in geometrically safe equipment. The functions of the mechanical cell will include sawing of end fittings, shearing through core material containing sections, examination of dissolver debris following chemical dissolution, and special operations such as separating the Yankee fuel element assembly. Hanford's current status under the Non-Production Fuels Processing Program is also described. (auth)

6326 TID-7583(p.41-55)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CHEMICAL PROCESSING OF POWER REACTOR FUELS BY THE HANFORD ATOMIC PRODUCTS OPERATION. A. M. Platt. 15p.

The chemical processing of low enrichment (less than 5% U^{235}), mechanically processed solid fuels to yield decontaminated and segregated uranium and plutonium products is described. Two step dissolution processes, i.e., cladding removal followed by core dissolution, will be employed in geometrically safe dissolvers. Dissolver effluents will be clarified, stored, and transferred to an existing Redox solvent extraction facility for decontamination and segregation of plutonium and uranium. Existing facilities will also be used for waste disposal. (auth)

6327 TID-7583(p.56-85)

[General Electric Co. Hanford Atomic Products Operation, Richland, Wash.].

MEASUREMENTS. K. M. Harmon and R. A. Schneider. 30p.

Hanford plans for the measurement of the nuclear materials content of non-production fuels are presented. A comparison of the expected reliability of calculated and measured values which will be obtained at various points in the over-all fuel cycle is made. Some of the key factors in the problem of reconciling values obtained at the various points are discussed. (auth)

6328 TID-7583(p.86-98)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ICPP PLANS FOR PROCESSING IRRADIATED FUELS FROM RESEARCH, TEST, AND POWER REACTORS. C. E. Stevenson. 13p.

The variety of highly enriched uranium fuels, which consist primarily of aluminum, zirconium, or stainless steel and are of various shapes and sizes, proposed for processing at the ICPP has been indicated. The applicable facilities and processes have been outlined to indicate the flexibility of this plant for handling all presently anticipated fuels in this category. (auth)

6329 TID-7583(p.99-112)

Phillips Petroleum Co. [Atomic Energy Div.], Idaho Falls, Idaho.

ICPP FACILITIES FOR RECEIVING STORAGE AND MECHANICAL TREATMENT. A. L. Ayers and C. B. Leek. 14p.

The ICPP facilities for unloading, storage and charging irradiated fuel elements are flexible enough to handle a large variety of fuels. However, if the fuel is to be handled efficiently and economically, there must be close liaison between the shipper and the plant. Casks up to 75 tons in weight may be received by rail or motor freight. Whether large or small, a shipping cask must be compatible with the available unloading and underwater handling equipment if the fuel is to be handled. The physical limitations for this equipment are readily available at ICPP. Complete data including detailed composition of the elements, geometric configuration, removable non-fuel bearing parts and criticality limitations including any neutron poison present in the fuel cask must be received by ICPP well in advance of any shipment. Inadequate or improper information can result in expensive special handling or return of the shipment. Fuel must have a minimum of 90 days cooling before it will be accepted for storage at ICPP. End plate cutting and simple dismantling can be carried out at ICPP, but complex mechanical operations can probably best be carried out at the reactor site. (auth)

6330 TID-7583(p.113-43)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ICPP DISSOLUTION, EXTRACTION, AND WASTE TREATMENT PROCESSES AND FACILITIES. F. Morgan Warzel. 31p.

The processes and facilities for dissolution, extraction, and waste treatment are described in detail, including chemical flowsheets and schematics of various processes. The limitations that exist for processing various fuels as to fuel size, shape, composition, and weight are discussed. (W.L.H.)

6331 TID-7583(p.158-66)

United Kingdom Atomic Energy Authority. Production Group. [Chemical Services Dept.], Windscale, Sellafield, England.

THE UNITED KINGDOM CIVIL POWER PROCESSING PROGRAMME. T. Tuohy. 9p.

Fuel handling at the reactor site and at the chemical processing plant is described. A brief description is given of existing chemical processing plant at Windscale. A brief description is also given of a proposed chemical processing plant. (W.L.H.)

6332 TID-7583(p.167-71)
European Co. for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
EUROCHEMIC, ITS HISTORY AND PROGRAM. E. Detilleux. 5p.

A brief discussion is presented of the History, site, process, and estimation of investment cost of the Eurochemic Separation Plant. (W.L.H.)

6333 TID-7583(p.172-3)
Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
PROCESSING POWER FUELS AT THE SAVANNAH RIVER PLANT. H. L. Hull. 2p.

Plans are being made to process fuels from Chalk River, Canada and Lagoona Beach, Michigan at the Savannah River Plant. (auth)

6334 TID-7583(p.174-86)
Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
MECHANICAL HANDLING OF CHALK RIVER AND PRDC FUEL. J. W. Langhaar. 13p.

NRU and NRX fuel from the reactors at Chalk River, Ontario, is shipped to the Savannah River Plant in a finned, externally air-cooled cask provided for this purpose. The cask has an internal length of 11 feet to accommodate full-length elements. At SRP the elements are placed in a dissolvable frame or "bundle," about 25 per bundle, for storage and subsequent handling. Two bundles at a time are shipped from storage to the separations plant in an available 70-ton cask which has been equipped with a suitable internal rack. It is planned to ship at least the first two charges of PRDC fuel to the Savannah River Plant. The blanket element end sections of the fuel assembly will have been removed at the reactor site. Criticality hazards will probably limit handling operations to four fuel assemblies in any basket or bundle. The shipping cask design has not yet been specified. The possible need for removing the stainless steel housing tube before processing is to be determined by studies of dissolver operation. (auth)

6335 TID-7583(p.187-94)
Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
CHEMICAL PROCESSING OF CHALK RIVER FUELS. H. L. Hull. 8p.

One of the existing Savannah River Plant dissolvers will be modified to accommodate eleven-foot long fuel elements from Chalk River, Canada. The aluminum cladding will be removed with sodium hydroxide, and the uranium cores will be dissolved in nitric acid. The Purex process, operated in mixer settlers, will be used to recover and decontaminate the uranium and plutonium in the core solution. (auth)

6336 TID-7583(p.195-205)
Du Pont de Nemours (E. I.) & Co., Wilmington, Del.
CHEMICAL PROCESSING OF PRDC CORE FUEL. H. L. Hull. 11p.

It is planned to process the PRDC core fuel elements in an existing stainless steel dissolver at the Savannah River Plant. The zirconium cladding will be dissolved in dilute hydrofluoric acid. The uranium-molybdenum alloy will be dissolved in nitric acid. Stainless steel portions of the fuel assemblies will be retrieved and buried. Chain nuclear fission will be avoided by keeping the uranium at low concentrations in solution and by handling the fuel in thin slabs. (auth)

6337 TID-7583(p.206-33)
Oak Ridge National Lab., Tenn.
FUEL PROCESSING FACILITIES AT ORNL. H. E. Goeller. 28p.

This paper is a presentation of the general contribution which ORNL expects to make to the Commission's Interim Reactor Fuel Processing Program and includes a description of the fuels to be processed; an enumeration of the processes to be used; a discussion of the facilities, both existing and planned, in which processing will be done; a brief summary of our construction and operating schedules; and an enumeration of some of the major problems which confront us under the program. These topics will all be expanded in the four papers which follow. (auth)

6338 TID-7583(p.234-305)
Oak Ridge National Lab., Tenn.
CHEMICAL PROCESSING OF POWER AND RESEARCH REACTOR FUELS AT OAK RIDGE NATIONAL LABORATORY. R. E. Blanco, L. M. Ferris, J. R. Flanary, F. G. Kitts, R. H. Rainey, and J. T. Roberts. 72p.

The reactor fuels have been divided into classes based on processing criteria. Class one fuels, stainless steel clad ThO_2–UO_2, are dissolved by either the Darex Process, Sulfex Process, or HNO_3 dissolution and the solvent extraction processes used are either acid Thorex or Darex–Thorex. Class two fuels, stainless steel clad UO_2, are dissolved by the same processes used in class one. The solvent extraction processes used are Darex–Purex and Purex. Class three fuels, stainless steel clad Na-bonded cores, are dissolved by caustic decladding, HNO_3 dissolution, and HNO_3–Fe dissolution. The solvent extraction processes used are Purex and acid Thorex. Class four fuels, Al-clad enriched U–Al alloy core, are dissolved by HNO_3–Hg process and the solvent extraction process is TBP-25. Class five fuels, Al-clad Th in core, are dissolved by caustic decladding, dilute HNO_3 bond dissolution, and HNO_3–F dissolution. The solvent extraction process used is acid Thorex. Class six fuels, Zr alloy-clad Zr–U alloy core, are dissolved by a modified Zirflex NH_4F dissolution. The solvent extraction process used is Purex. Class seven fuels, aqueous solution or slurry, are processed by HNO_3–F dissolution and HNO_3 dilution. The solvent extraction processes used are TBP-25 and acid Thorex. The reactors that these fuels are taken from are listed. Flowsheets are given for the various processes discussed. The disposal of the high and low level wastes resulting from chemical processing is discussed. (W.L.H.)

6339 TID-7583(p.306-99)
Oak Ridge National Lab., Tenn.
MECHANICAL PROCESSING OF SPENT POWER REACTOR FUEL AT OAK RIDGE NATIONAL LABORATORY. C. D. Watson, J. B. Adams, G. K. Ellis, G. A. West, F. L. Hannon, W. F. Schaffer, and B. B. Klima. 94p.

The mechanical processing of spent power reactor fuels as an aid to or as a substitute for chemical head ends is being actively investigated by Oak Ridge National Laboratory in two development programs: 1. Underwater mechanical equipment program for the predissolution treatment of fuel to eliminate massive inert hardware and disassembly of fuel (if required) to facilitate processing of fuel on a production level in the Power Reactor Fuel Processing Pilot Plant now being erected. 2. Dry cave mechanical equipment program to determine the feasibility of dejacketing stainless steel-clad NaK- or Na-bonded fuels of uranium and uranium-molybdenum and of shearing (chopping) and leaching metallic-clad tubular fuel arrays of the oxides of uranium and/or thorium. An underwater facility to receive, store, remove inert hardware, and disas-

semble and charge fuel to charger carriers has been designed and most of the features accepted for final design. Full-sized equipment, consisting of carriers, a traversing table, disassembly saw, hydraulic dejacketer, auxiliary dejacketer, slug washer, and slug canner for dejacketing and handling the stainless steel-clad NaK-bonded fuel of the SRE Core 1 has been built but is not yet evaluated. Disassembly, chopping, and leaching tubular assemblies has been shown to be feasible in laboratory investigations. A prototype shear is being designed and full-scale batch and continuous leachers have been fabricated for testing. (auth)

6340 TID-7583(p.400-31)
Oak Ridge National Lab., Tenn.
SPECIAL PROBLEMS IN CHEMICAL PROCESSING AT ORNL. A. R. Irvine. 32p.

The processing of power reactor fuels at ORNL will require the solution to a number of new or especially difficul problems. These problems reflect the change in fuel element composition brought about by the demand for heat generation in a useful temperature range and at maximum emission rate, both of which are necessary to the production of economic nuclear power. This demand for economic nuclear power has led to the use of claddings which are highly corrosion resistant, to ceramic or alloy core materials because of their resistance to radiation damage, and to an increase in U^{235} enrichment of core material. Each of these innovations contributes significant processing problems at ORNL, some of which are discussed. (auth)

6341 TID-7583(p.432-46)
Oak Ridge National Lab., Tenn.
ACCOUNTABILITY OF SPECIAL NUCLEAR MATERIAL AT OAK RIDGE NATIONAL LABORATORY. W. T. McDuffee. 15p.

The accountability program currently in use at the Oak Ridge National Laboratory is discussed. (W.L.H.)

6342 UCRL-8748
California. Univ., Berkeley. Lawrence Radiation Lab.
A METHOD OF PURIFICATION OF AMERICIUM. Keiji Naito. Nov. 1959. 23p. Contract W-7405-eng-48. OTS.

As one of the general methods of purification of americium the rough separation of the impurities by using precipitation method and the purification by using ion exchange method were tried and satisfactory results were obtained. In this experiment, all impurities except aluminum and manganese were separated from americium using the anion exchange separation with 9 M HCl eluant and with 5 M NH_4SCN eluant. Aluminum and manganese can be separated using NaOH dissolution and 2 M NH_4SCN elution: methods which are applicable together with the above-mentioned anion exchange methods. Some interesting facts were observed during the process of elution with NH_4SCN from the cation and anion exchange columns. (auth)

6343
IDAHO FALLS: ATOMS IN THE DESERT. Chem. Eng. 67, No. 2, 105-110(1960) Jan. 25.

The processes of receiving, handling, and storing different reactor fuels at the Idaho Chemical Processing Plant are described. The various types of fuel elements processed and the processes utilized are enumerated. The safety hazards involved in criticallity and waste disposal are discussed. (C.J.G.)

6344
RECIPROCAL INFLUENCE OF RARE-EARTH ELEMENTS WHEN EXTRACTED BY TRIBUTYLPHOSPHATE. A. V. Nikolaev and A. A. Sorokina (Inst. of Inorganic Chemistry, Siberian Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 129, 341-4(1959) Nov. 11. (In Russian)

The reciprocal influence of rare elements in tributyl phosphate extraction was investigated using neodymium, samarium, and ytterbium in nitric acid media. Direct acidity after introducing rare earth salts was ~12 N. The tabulated results show that instead of salting out, a reverse reaction takes place (the self-salting effect). The self-salting is the result of limited rare earth solubility in the organic phase. With yttrium, the stronger the extraction the earlier the self-salting process appears. However, with Nd and Sm the recovery remains constant until the indicator concentration is about 5%. Two series of experiments were undertaken in order to clarify the reciprocal effect. The first series determined the effects of concentrations of cerium earths on the TBP solvent extraction of neodymium, samarium, yttrium, holmium, and ytterbium in nitric acid, with the aqueous to organic ratio 3:1. The composition of the didymium according to spectral lines was 55% Nd, 17% Pr, 3.7% Sm, 7.0% La, 0.72% Eu, 0.7% Gd, < 0.4% Dy, < 0.1% Er, 0.04% Yb, 0.04% Lu, and < 0.1% V. In some cases the didymium concentration of 2 to 5% does not show any effects, and while 20% reduces the extraction of all rare earth elements except ytterbium. The absence of didymium effects on yttrium and its weak effects on Y and Ho suggested that the yttrium earth reciprocal effects would be stronger, especially in cerium earths. Hence, a second series of experiments was made with yttrium concentrates of 2.5% Nd, 0.7% Pr, 2.4% Sm, 4.3% La, < 0.1% Eu, 4.0% Gd, 1.4% Tb, 52% Dy, 4.3% Er, 0.9% Tm, 6.5% Lu, 1.45% V. It was observed that even 2% concentration of the admixture affects the reaction for all rare earths. (R.V.J.)

6345
SEPARATION OF ZINC AND CADMIUM BY DITHIZONE AND TRILON. A. K. Babko and A. Kh. Klibus (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk Ukr. R.S.R. No. 9, 991-4(1959). (In Ukrainian)

Besides the electronic structure of the central ion of the complex, a cause of retardation of the complex formation reaction may be the structural properties of the addend. Such a phenomenon is noted in the interaction of metals with (ethylenediamine)tetraacetic acid (EDTA). The calculation of the equilibrium constant of zinc dithizonates and cadmium with EDTA showed that the equilibrium of the reaction may be shifted, in the presence of a definite excess of EDTA, in the direction of dithizonate decay more readily for cadmium than for zinc. It was ascertained experimentally that the rates of the processes of forming complexes of cadmium and zinc with EDTA differ greatly and may become the criterion for a method of separating Cd and Zn. The conditions for separation of Cd and Zn were investigated. The authors studied the effect of the pH, temperature, and trilon B concentration on the reaction rate of the interaction of zinc and cadmium dithizonates with trilon B. A method was developed on the basis of these experiments for the separation of small and approximately equal quantities of zinc and cadmium. (auth)

6346
THE CO-PRECIPITATION OF PROTACTINIUM WITH THE DIOXIDES OF MANGANESE, LEAD, AND TIN. C. A. Goodall and R. L. Moore (General Electric Co., Richland, Wash.). J. Inorg. & Nuclear Chem. 11, 290-6(1959) Dec.

The scavenging of Pa^{233} from thorium-nitric acid solutions was studied with a variety of adsorbents and as a

function of pertinent solution variables. Co-formed MnO_2, PbO_2, and SnO_2 were particularly effective. High concentrations of thorium or nitric acid and high radiation levels were detrimental. Fluoride, phosphate, and zirconium ions also interfered with protactinium precipitation. These results implied the formation of 1:1 protactinium–fluoride and protactinium–phosphate complexes which were about 60 and 10^3 times more stable than the corresponding thorium complexes. (auth)

6347

THE ELECTRODEPOSITION OF BERYLLIUM FROM NON-AQUEOUS SOLUTIONS. I. A. Menzies, D. L. Hill, and L. W. Owen (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Less-Common Metals 1, 321-30(1959) Aug. (In English)

Electrolyses of solutions of beryllium chloride in anhydrous liquid ammonia were carried out at −33°C using platinum and beryllium anodes and copper and beryllium cathodes. Gassing occurred at both anode and cathode in all electrolyses but no metal was deposited at the cathode. The anodic dissolution and cathodic re-deposition of beryllium in fused-salt baths at 400 to 500°C was studied. Beryllium dissolves anodically in eutectic mixtures of LiCl–KCl and NaCl–$BeCl_2$ and metal of 99.5% purity is obtained at the cathode. The general features of such systems and the effect of complex ion formation on the possible deposition mechanisms are discussed. (auth)

6348

THE EXTRACTION OF IRON(III) FROM ACID PERCHLORATE SOLUTIONS BY DI-(2-ETHYLHEXYL)-PHOSPHORIC ACID IN n-OCTANE. C. F. Baes, Jr. and H. T. Baker (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 89-94(1960) Jan.

The distribution of iron(III) between acidic aqueous perchlorate solutions and solutions of di-(2-ethylhexyl)-phosphoric acid [$(RO)_2PO_2H$, DPA] in n-octane was examined as a function of various extraction variables at constant aqueous ionic strength. The organic solutions involved were investigated by means of isopiestic molecular weight determinations and viscosity measurements. The distribution behavior at low iron levels (iron : DPA < 0.1) is consistent with the formation of the extraction complex, FeX_3H_3, in which X denotes the anion $(RO)_2PO_2^-$. However, the DPA concentration dependence of extraction indicates partial trimerization of (dimeric) DPA in octane, $3(HX)_2 \rightleftharpoons 2(HX)_3$, with an equilibrium constant of ca. 10 M^{-1}. The results at high iron levels suggest the formation of two additional iron : DPA complexes, $[Fe_2X_6ClO_4 \cdot \sim 5H_2O]_n (n \sim 4)$ and $Fe_2X_6ClO_4(OH)_6 \cdot \sim 7H_2O$. (auth)

6349

SEPARATION OF ZIRCONIUM AND HAFNIUM USING ANION-EXCHANGE RESINS. PART III. RESOLUTION OF HAFNIA CONCENTRATES. K. S. Rajan and J. Gupta (National Chemical Lab., Poona, India). J. Sci. Ind. Research (India) 18B, 460-3(1959) Nov.

The anion-exchange method of separating hafnium from zirconium previously reported for resolving a naturally occurring mixture (Hf/Zr, 3%) was modified and applied to hafnia concentrates. A complete separation of the two constituents was achieved on a sulfate exchanger by elution with dilute sulfuric acid. About 50% of the eluting acid (pre-breakthrough volume) can be recycled. Gram loads of hafnia concentrates were found to give 93 to 95% recovery of pure hafnia (Zr/Hf, < 0.1%) on 1.5 × 120 cm resin columns. (auth)

6350

CONDENSATION PROCESSES FOR THE EXTRACTION OF RADIOACTIVITY FROM AIR. Rama (Tata Inst. of Fundamental Research, Bombay). Nature 184, Suppl. 23, 1789-90 (1959) Dec. 5.

Results are reported from an investigation of procedures for the separation of very fine radioactive aerosols from the atmosphere. A method is described which involves passing air through an air conditioning coil and condensing some of the moisture on the cold fins. It is believed that the method shows promise for the removal of radioactivity from large quantities of air. (C.H.)

6351

SEPARATION OF NIOBIUM AND TANTALUM BY THE LIQUID EXTRACTION METHOD. D. I. Ryabchikov and M. P. Volynets (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 14, 700-4 (1959) Nov.-Dec. (In Russian)

With the use of radioactive indicators, the influence of hydrofluoric acid and tributyl phosphate concentrations, temperature, and hydrochloric and sulfuric acids on the distribution of niobium and tantalum fluoride complexes between water phase and tributyl phosphate, when the extraction is carried out in static conditions, was studied. The method developed for the separation of niobium and tantalum can be used for the analysis of binary tantalum–niobium alloys. An extraction packing continuous column was used for separating mixtures of tantalum and niobium. It was shown that in the conditions adopted (h_e of packing is 144 mm) it is possible to obtain niobium of 99.7 to 100% purity. (auth)

6352

PRELIMINARY GEOLOGIC MAP OF THE MOQUI SE QUADRANGLE, MONTEZUMA COUNTY, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-221. E. B. Ekren and F. N. Houser. Washington, U. S. Geological Survey. 1959. $0.50(USGS).

6353

SEPARATION OF FISSION PRODUCTS FROM IRRADIATED URANIUM. (to United Kingdom Atomic Energy Authority). British Patent 817,861. Aug. 6, 1959.

The processing of irradiated U fuel by distillation is described. Heating to 1250°C distills off most fission products and rapid heating to 1400°C removes Pu. (T.R.H.)

6354

PROCESS FOR EXTRACTING AND SEPARATING NIOBIUM AND TANTALUM. (to CIBA, Ltd.). British Patent 825,604. Dec. 16, 1959.

A process is described for separating Ta and Nb in ores, oxide mixtures, slags, or concentrates. The oxides are chlorinated to produce Nb oxychloride and $TaCl_5$. The $TaCl_5$ can then be extracted with liquid SO_2. (T.R.H.)

6355

DISPERSION SEPARATION. (to United Kingdom Atomic Energy Authority). British Patent 825,923. Dec. 23, 1959.

A device is described which will separate immiscible phases in a dispersion, for example furfural and heptane. The dispersion is stirred under pressure in a vessel which has a porous membrane through which one phase flows to another container. The choice of porous membrane and pressure varies with the materials to be separated and the desired degree of separation. An example is given in which fritted glass of pore size 35 to 85 μ gave 100% separation of ether and water at 29.8 mm Hg and a rate of 10 cc/min. (T.R.H.)

6356
RECOVERY OF URANIUM VALUES FROM RESIDUES. Ward B. Schaap (to U. S. Atomic Energy Commission). U. S. Patent 2,900,226. Aug. 18, 1959.

A process is described for the recovery of uranium from insoluble oxide residues resistant to repeated leaching with mineral acids. The residue is treated with gaseous hydrogen fluoride, then with hydrogen and again with hydrogen fluoride, preferably at 500 to 700°C, prior to the mineral acid leaching.

6357
SELECTIVE SEPARATION OF URANIUM FROM THORIUM, PROTACTINIUM AND FISSION PRODUCTS BY PEROXIDE DISSOLUTION METHOD. G. T. Seaborg, J. W. Gofman, and R. W. Stoughton (to U. S. Atomic Energy Commission). U. S. Patent 2,900,228. Aug. 18, 1959.

A method is described for separating U^{233} from thorium and fission products. The separation is effected by forming a thorium–nitric acid solution of about 3 pH, adding hydrogen peroxide to precipitate uranium and thorium peroxide, treating the peroxides with sodium hydroxide to selectively precipitate the uranium peroxide, and reacting the separated solution with nitric acid to re-precipitate the uranium peroxide.

6358
URANIUM LEACHING AND RECOVERY PROCESS. L. A. McClaine (to U. S. Atomic Energy Commission). U. S. Patent 2,900,229. Aug. 18, 1959.

A process is described for recovering uranium from carbonate leach solutions by precipitating uranium as a mixed oxidation state compound. Uranium is recovered by adding a quadrivalent uranium carbonate solution to the carbonate solution, adjusting the pH to 13 or greater, and precipitating the uranium as a filterable mixed oxidation state compound. In the event vanadium occurs with the uranium, the vanadium is unaffected by the uranium precipitation step and remains in the carbonate solution. The uranium-free solution is electrolyzed in the cathode compartment of a mercury cathode diaphragm cell to reduce and precipitate the vanadium.

6359
APPARATUS FOR CHARGING A RECEPTACLE WITH A DENSE SUBLIMATE FORM OF URANIUM CHLORIDE. P. H. Davidson (to U. S. Atomic Energy Commission). U. S. Patent 2,900,237. Aug. 18, 1959.

An apparatus for filling a tubular storage receptacle with a dense massive form of uranium chloride is described. The apparatus includes an evacuated housing divided into a vaporizing chamber and a portion adapted to receive the receptacle. A nozzle conducts vaporized uranium chloride from the chamber to the interior of the receptacle. The nozzle is withdrawable to progressively deposit the uranium chloride under controlled conditions to produce a dense sublimate which fills the receptacle.

6360
SEPARATION OF PLUTONIUM. A. G. Maddock and F. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,901,313. Aug. 25, 1959.

A method is described for separating plutonium from uranium and fission products by treating a nitrate solution of fission products, uranium, and hexavalent plutonium with a relatively water-insoluble fluoride to adsorb fission products on the fluoride, treating the residual solution with a reducing agent for plutonium to reduce its valence to four and less, treating the reduced plutonium solution with a relatively insoluble fluoride to adsorb the plutonium on the fluoride, removing the solution, and subsequently treating the fluoride with its adsorbed plutonium with a concentrated aqueous solution of at least one of a group consisting of aluminum nitrate, ferric nitrate, and manganous nitrate to remove the plutonium from the fluoride.

6361
REMOVAL OF URANIUM FROM ORGANIC LIQUIDS. S. P. Vavalides (to U. S. Atomic Energy Commission). U. S. Patent 2,901,314. Aug. 25, 1959.

A process is described for recovering small quantities of uranium from organic liquids such as hydrocarbon oils, halogen-substituted hydrocarbons, and alcohols. The organic liquid is contacted with a comminuted alkaline earth hydroxide, calcium hydroxide particularly, and the resulting uranium-bearing solid is separated from the liquid by filtration. Uranium may then be recovered from the solid by means of dissolution in nitric acid and conventional extraction with an organic solvent such as tributyl phosphate.

6362
REMOVAL OF ALUMINUM COATINGS. J. H. Peterson (to U. S. Atomic Energy Commission). U. S. Patent 2,901,3[illegible] Aug. 25, 1959.

A process is presented for dissolving aluminum jackets from uranium fuel elements without attack of the uranium in a boiling nitric acid–mercuric nitrate solution containing up to 50% by weight of nitric acid and mercuric nitrate in a concentration of between 0.05 and 1% by weight.

6363
SALICYLATE PROCESS FOR THORIUM SEPARATION FROM RARE EARTHS. G. A. Cowan (to U. S. Atomic Energy Commission). U. S. Patent 2,901,496. Aug. 25, 1959.

The separation of thorium from rare earths is accomplished by forming an aqueous solution of salts of thorium and rare earths and sufficient acetate buffer to provide a pH of between 2 and 5, adding an ammonium salicylate to the aqueous buffered solution, contacting the resultant solution with a substantially water-immiscible organic solvent mixture of an ether and an ester, and separating the solvent extract phase containing thorium salicylate from the aqueous phase containing the rare earths.

6364
SEPARATION OF THORIUM FROM URANIUM. R. W. Bane (to U. S. Atomic Energy Commission). U. S. Patent 2,902,338. Sept. 1, 1959.

A description is given for the separation of thorium from uranium by forming an aqueous acidic solution containing ionic species of thorium, uranyl uranium, and hydroxylamine, flowing the solution through a column containing a phenol-formaldehyde type cation exchange resin to selectively adsorb substantially all the thorium values and a portion of the uranium values, flowing a dilute solution of hydrochloric acid through the column to desorb the uranium values, and then flowing a dilute aqueous acidic solution containing an ion, such as bisulfate, which has a complexing effect upon thorium through the column to desorb substantially all of the thorium.

6365
RECOVERY OF PLUTONIUM FROM AQUEOUS SOLUTIONS. E. J. Reber (to U. S. Atomic Energy Commission). U. S. Patent 2,902,339. Sept. 1, 1959.

A process is described for recovering plutonium values from aqueous solutions by precipitation on bismuth phosphate. The plutonium is secured in its tetravalent state, bismuth salt is added to the solution, and an excess of phosphoric acid anions is added to the solution in two approximately equal installments. The rate of addition of the

first installment is about two to three times as high as the rate of addition of the second installment, whereby a precipitate of bismuth phosphate forms, the precipitate carrying the plutonium values. The precipitate is separated from the solution.

6366

A CHEMICAL METHOD OF TREATING FISSIONABLE MATERIAL. Carl M. Olson (to U. S. Atomic Energy Commission). U. S. Patent 2,902,340. Sept. 1, 1959.

One step of a process for separating plutonium from uranium and fission products is presented. A nitric acid solution containing these constituents is treated with formic acid to reduce simultaneously the plutonium to a valence state of not greater than +4 and destroy and eliminate the excess nitric acid.

6367

PURIFICATION OF URANIUM FUELS. L. W. Niedrach and A. C. Glamm (to U. S. Atomic Energy Commission). U. S. Patent 2,902,415. Sept. 1, 1959.

An electrolytic process of refining or decontaminating uranium is presented. The impure uranium is made the anode of an electrolytic cell. The molten salt electrolyte of this cell comprises a uranium halide such as UF_4 or UCl_3 and an alkaline earth metal halide such as $CaCl_2$, BaF_2, or $BaCl_2$. The cathode of the cell is a metal such as Mn, Cr, Co, Fe, or Ni which forms a low melting eutectic with U. The cell is operated at a temperature below the melting point of U. In operation the electrodeposited uranium becomes alloyed with the metal of the cathode, and the low melting alloy thus formed drips from the cathode.

6368

RECOVERY OF METAL VALUES FROM AQUEOUS SOLUTIONS BY SOLVENT EXTRACTION. R. L. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,902,454. Sept. 1, 1959.

An organic solvent mixture is described for extracting actinides from aqueous solutions; the solvent mixture consists of from 10 to 25% by volume of tributyl phosphate and the remainder a chlorine–fluorine-substituted saturated hydrocarbon having two carbon atoms in the molecule.

6369

RECOVERY OF URANIUM BY SECONDARY XANTHATE COMPLEXING. O. K. Neville (to U. S. Atomic Energy Commission). U. S. Patent 2,902,503. Sept. 1, 1959.

A method is described for separating and recovering uranium values contained in an acidic aqueous solution together with thorium or protactinium values. In accordance with the invention, the acidic solution containing uranium in the uranyl form is contacted with an organic xanthate. The xanthate forms a urano-xanthate complex but is substantially non-reactive with thorium and protactinium. The urano-xanthate complex is recovered by organic solvent extraction.

6370

URANIUM SOLVENT EXTRACTION PROCESS. Charles D. Harrington (to U. S. Atomic Energy Commission). U. S. Patent 2,903,331. Sept. 8, 1959.

A method is given for extracting uranium values from ores of high phosphate content consisting of dissolving them in aqueous nitric acid, adjusting the concentration of the aqueous solution to about 2 M with respect to nitric acid, and then contacting it with diethyl ether which has previously been made 1 M with respect to nitric acid.

6371

SEPARATION OF RUTHENIUM FROM AQUEOUS SOLUTIONS. C. F. Callis and R. L. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,903,332. Sept. 8, 1959.

The separation of ruthenium from aqueous solutions containing uranium, plutonium, ruthenium, and fission products is described. The separation is accomplished by providing a nitric acid solution of plutonium, uranium, ruthenium, and fission products, oxidizing plutonium to the hexavalent state with sodium dichromate, contacting the solution with a water-immiscible organic solvent, such as hexone, to extract plutonyl, uranyl, ruthenium, and fission products, reducing with sodium ferrite the plutonyl in the solvent phase to trivalent plutonium, re-extracting from the solvent phase the trivalent plutonium, ruthenium, and some fission products with an aqueous solution containing a salting out agent, introducing ozone into the aqueous acid solution to oxidize plutonium to the hexavalent state and ruthenium to ruthenium tetraoxide, and volatizing off the ruthenium tetraoxide.

6372

RARE EARTH-ACTINIDE SEPARATION BY ADSORPTION. C. S. Lowe and W. H. McVey (to U. S. Atomic Energy Commission). U. S. Patent 2,903,333. Sept. 8, 1959.

Separation of Zr and Nb from aqueous solution by adsorption on glass beads is described. Borosilicate glass is used which is substantially free of Mg, Ca, and Zn.

6373

SEPARATION OF FISSION PRODUCTS FROM PLUTONIUM BY PRECIPITATION. G. T. Seaborg, S. G. Thompson, and N. R. Davidson (to U. S. Atomic Energy Commission). U. S. Patent 2,903,335. Sept. 8, 1959.

Fission product separation from hexavalent plutonium by bismuth phosphate precipitation of the fission products is described. The precipitation, according to this invention, is improved by coprecipitating ceric and zirconium phosphates (0.05 to 2.5 grams/liter) with the bismuth phosphate.

6374

RECOVERY OF VALUABLE MATERIAL FROM GRAPHITE BODIES. L. W. Fromm, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,903,402. Sept. 8, 1959.

An electrolytic process for recovering uranium from a graphite fuel element is described. The uranium-containing graphite body is disposed as the anode of a cell containing a nitric acid electrolyte and a 5 amp/cm^2 current passed to induce a progressive disintegration of the graphite body. The dissolved uranium is quickly and easily separated from the resulting graphite particles by simple mechanical means, such as centrifugation, filtration, and decontamination.

6375

METHOD OF SEPARATION OF PLUTONIUM FROM CARRIER PRECIPITATES. L. R. Dawson (to U. S. Atomic Energy Commission). U. S. Patent 2,905,525. Sept. 22, 1959.

The recovery of plutonium from fluoride carrier precipitates is described. The precipitate is dissolved in zirconyl nitrate, ferric nitrate, aluminum nitrate, or a mixture of these complexing agents, and the plutonium is then extracted from the aqueous solution formed with a water-immiscible organic solvent.

6376

REDUCTION IN Pu RECOVERY PROCESSES. D. M. Ritter and R. P. S. Black (to U. S. Atomic Energy Commission). U. S. Patent 2,906,597. Sept. 29, 1959.

A method is described for reducing plutonium from the hexavalent to the tetravalent state in a carrier precipitation process for separating plutonium and nuclear

fission products. In accordance with the invention oxalate ions are incorporated in the hexavalent plutonium-containing solution prior to a step of precipitating lanthanum fluoride in the solution.

ENGINEERING AND EQUIPMENT

General and Miscellaneous

6377 BNL-567

Brookhaven National Lab., Upton, N. Y.

THEORETICAL AND EXPERIMENTAL STUDIES OF SODIUM IRRADIATOR SYSTEMS. O. A. Kuhl, L. Galanter, S. Zwickler, and B. Manowitz. May 1959. 22p. OTS.

There are several important parameters associated with the design of slab irradiators. Target parameters include dimensions, density, and composition. Source parameters include composition (photon energy, source density, and atomic number), total activity (curies), average specific activity, activity distribution, source dimensions, and source-to-target geometry. Large-scale sources of low activity were assembled. The Na^{24} was in the form of a dilute aqueous solution of $Na_2^{24}CO_3$, specific gravity 1, contained in rectangular slabs 1 and 2 inches thick, and 2 feet wide by 16 feet long. Static targets of paraffin wax were used in all experiments. Exposure doses at various points in and on the target surfaces over known periods of time were measured with calibrated instruments. The specific activity was determined by radiochemical analysis on a known volume at a specific time; and, by relating this result to total volume, the total activity could be obtained. Source and target parameters were varied, and specific dose rates and dose distributions were obtained as functions of these variations. Theoretical calculations were made by dividing the source into a number of line elements and using the uncollided flux equation with NDA-NBS build-up factors modified for finite media. The contribution of each element to various points in the target was calculated. The theoretical results are compared with those obtained experimentally, and the degree of conformity of these comparisons is discussed. (auth)

6378 HW-62177

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STATISTICAL ANALYSIS—ACCURACY OF VOLUME MEASUREMENTS IN A LARGE PROCESS VESSEL. C. G. Hough. Oct. 20, 1959. 36p. Contract AT(45-1)-1350. OTS.

An analysis of the precision and accuracy of information contained in report HW-62049 on process vessel calibration tests is presented. The methods of vessel calibration are considered along with liquid level measuring equipment. Calculation methods are also analyzed and the advantages of these over other least square procedures are pointed out. (J.R.D.)

6379 NP-8266

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

AN ELECTROMAGNETIC SHOCK TUBE FOR AERODYNAMIC RESEARCH. Richard W. Ziemer. June 17, 1958. 24p. Contract AF04(647)-127.

An electromagnetically driven shock tube was studied as a possible new tool for aerodynamic research in which velocities of up to 41,000 fps are obtainable in air. At these high velocities stagnation temperatures of about 35,000°K are produced. The simple construction and operation of the shock tube is described and an evaluation is made of its performance. The potentialities and limitations of the apparatus are discussed with regard to research applications. The results of some magneto-aerodynamic studies are presented to show the usefulness of this type of shock tube. (auth)

6380 WADC-TR-56-272(Pt.IV)

Boeing Aircraft Co., Seattle.

DESIGN DATA FOR O-RINGS AND SIMILAR ELASTIC SEALS. [Period covered] May 1, 1958 to June 30, 1959. George E. Trepus, Robert S. Roper, and William R. Hickman. July 30, 1959. 152p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: ELASTOMERIC AND COMPLIANT MATERIALS. Contract AF33(616)-5722.

Design criteria for O-rings, back-up rings, and other elastomeric seals were determined. A survey of current literature concerning seals and seal materials was conducted with an emphasis placed on seals and seal materials for use in environmental extremes. Tensile properties of a number of silicone and Viton compounds are given. The effects of environment and groove configurations on the sealing force of an O-ring were determined. Thermal expansion and compression modulus tests were performed on elastomeric materials at cryogenic temperatures. The functional tests included pneumatic seal tests at 400°F, hydraulic rod seal tests at 400°F using O-rings and back-up rings made from a variety of materials and in several configurations, static annulus tests at elevated temperatures using various groove configurations, and static seal tests using helium at cryogenic temperatures. Certain physical properties were found to be of value to the life of a seal under specific environmental and/or mechanical conditions. (auth)

6381 WADC-TR-59-428

Boeing Airplane Co., Seattle.

DESIGN HANDBOOK FOR O-RINGS AND SIMILAR ELASTIC SEALS. Period covered: July 1955 to June 1959. Frank W. Tipton. Sept. 8, 1959. 71p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: ELASTOMERIC AND COMPLIANT MATERIALS. Contract AF33(616)-5722.

The mechanism of O-ring sealing, the relation of physical properties to sealing, the effect of cavity configuration, back-up rings and adverse mechanical conditions on seal life and the design of seals for specific systems are considered. Test procedures and a bibliography of published articles pertinent to O-ring seals are included. (auth)

6382 DSI-tr-341

SOVIET GAS TURBINE RESEARCH. PART II. AERODYNAMIC CASCADE TESTS AT HIGH SUBSONIC AND AT SUPERSONIC VELOCITIES. G. S. Samoilovich. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 9, 80-4(1954). CALCULATION OF THE TEMPERATURE DISTRIBUTION IN A GAS TURBINE ROTOR UNDER TRANSIENT CONDITIONS. E. I. Molchanov. Teploenergetika 3, No. 1, 53-7 (1956). DETERMINATION OF TEMPERATURE FIELD IN ELEMENTS OF GAS TURBINES BY THE METHOD OF ELECTRICAL MODELLING. K. P. Seleznev. Energomashinostroenie No. 3, 8-10(1956). 16p. Part I issued as DSI-tr-339.

6383 DSI-tr-429

SOVIET GAS TURBINE RESEARCH. PART III. THE EFFECT OF SOME FACTORS ON THE TEMPERATURE DISTRIBUTION IN THE ROTOR OF A GAS TURBINE. K. P. Seleznev and A. I. Taranin. Energomashinostroenie No. 1, 21-6(1958). THE QUEST FOR HIGHLY-EFFICIENT HEAT EXCHANGERS FOR GAS TURBINE INSTALLATIONS. L. G. Gel'fenbein. Ibid. 27-30(1958). CONFER-

ENCE ON LONG-TERM STATIC STRENGTH OF TURBOMACHINES. V. K. Naumov. Ibid. 47(1958). RECENT WORK AT THE TsKTI. Ibid. 48(1958). 28p.

Parts I and II issued as DSI-tr-339 and DSI-tr-341, respectively.

6384 SCL-T-291

SMALL VIBRATIONS OF THIN, ELASTIC CONICAL SHELLS. (O Malykh Kolebaniyakh Tonkikh Uprugikh Konicheskikh Obolochek). E. I. Grigolyuk. Translated by Marcel I. Weinreich (Sandia Corp.) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 6, 35-44(1956). 16p. JCL or LC.

A mathematical analysis of small eigen vibrations of thin conical elastic shells is presented. The energetic method, which may be applied to shells of any pitch with supported edges, is used. Results for cylindrical shells are also obtained. Comparisons of experimental data and computations are presented tabularly. (J.R.D.)

6385

A POWER EXPLOSIBILITY TESTER WITH CONTINUOUS FEED. W. D. Box (Oak Ridge Gaseous Diffusion Plant, Tenn.). ASTM Bull. No. 241, 34-7(1959) Oct.

A system for continuous testing the explosibility of powdered materials was developed. The limits of concentration of powder in air within which explosions occur can be simply and repeatably determined by continuously varying the flow ratio of sample to air until the mixture ignites. A precision of ±0.007 g sample per liter of air, at the 96% confidence level, was obtained for each of ten measurements with a powder consisting of 90% Al and 10% inert material that exploded at an average concentration of 0.307 g sample per liter of air. Samples of aluminum, coal, sugar, and flour were tested successfully in the apparatus. Samples of copper and nickel, tested by the same method, did not explode in the concentration range between 0.003 and 0.353 g per liter. (auth)

6386

AXIAL, RELATIVE MOTION OF A CIRCULAR STEP BEARING. Lagar Licht (Franklin Inst., Philadelphia). J. Basic. Eng. 81, 109-17(1959) June.

Equations relating the flow of the lubricant and the axial motion of an externally pressurized thrust bearing are developed. The bearing is shown to be stable when the fluid is incompressible. Expressions for local stiffness and damping coefficients, useful in the evaluation of the dynamic response of the bearing, are given. An analog computer solution of the equation of motion is compared with the results of the corresponding, small displacement equation. (auth)

6387

HYDRAULIC POWER HACKSAW FOR RADIOACTIVE MATERIAL. Machinery 95, 235-7(1959) Aug. 12.

The design and operation of a hydraulically-operated power hacksaw for radioactive materials are given. The machine is designed for remote control by a manually-operated mechanical manipulator and a hydraulic system with a pressure supply of 1500 psi. (C.J.G.)

6388

DESIGN AND PERFORMANCE OF GAS TURBINE POWER PLANTS. HIGH SPEED AERODYNAMICS AND JET PROPULSION. VOLUME XI. W. R. Hawthorne and W. T. Olson, eds. Princeton, N. J., Princeton University Press, 1960. 573p. $15.00.

Various aspects of combustion chamber design such as fuel injection, flame stabilization, fuels, and fuel mixing processes are described and explained. Experimental techniques used to obtain pressure, velocity, temperature, etc., measurements are described. The development, performance, and factors affecting design of combustion chamber gas turbines are discussed. The mechanics and metallurgical properties of materials which have applications in gas turbines are given. The aerodynamics of blade vibrations is considered. Various performance criteria used in the design of gas turbines are presented. (C.J.G.)

6389

IMPROVEMENTS IN OR RELATING TO GO-DEVILS. Sidney Jefferson and John Crawford Daglish. (to United Kingdom Atomic Energy Authority). British Patent 817,567. July 29, 1959.

A go-devil, for cleaning clogged pipes, is described which contains a means of exposing a radioactive source so that it can be located even several feet in the ground. A bellows arrangement in the device is actuated by pressure in the pipe to remove the radioactive source from a shielded portion of the go-devil. A spring returns the source to the shield when pressure is withdrawn. Thus handling the go-devil in putting it in the pipe and removing it is made safer from the danger of radiation exposure. (T.R.H.)

6390

IMPROVEMENT IN OR RELATING TO PUMPS. Horace Frank Parker. (to United Kingdom Atomic Energy Authority). British Patent 817,872. Aug. 6, 1959.

A pump design is offered which is suitable for use as a constant volume feed pump. It is simple in construction and requires little maintenance. It consists of a tank in which a constant liquid level is maintained by an overflow pipe, and a cylinder and piston. The cylinder is closed at the submerged end but has openings near the liquid level which allow it to fill. The piston when moved down forces a volume of liquid through the piston to the top of the cylinder in direct proportion to the length of the piston stroke. The desired volume-rate of flow is obtained by adjusting the piston-stroke length. (T.R.H.)

6391

IMPROVEMENTS IN OR RELATING TO PACKINGS FOR LIQUID-LIQUID EXTRACTION COLUMNS. Dennis Harold Logsdail (to United Kingdom Atomic Energy Authority). British Patent 818,272. Aug. 12, 1959.

A perforated conical plate is described which, if used to replace every fourth or fifth plate in a liquid-liquid extraction column, gives good redistribution. The cone height should be as high as inter-plate space allows. An example is given which is 6 in. in diam., 2 in. high and $\frac{1}{8}$ in. thick. The perforations are $\frac{1}{8}$ in. diam. and occupy 25% of the area. (T.R.H.)

6392

IMPROVEMENTS IN OR RELATING TO HYDRODYNAMIC GAS BEARINGS. George William Kinvig Ford, David Melvyn Harris, and Derrick Pantall (to United Kingdom Atomic Energy Authority). British Patent 818,588. Aug. 19, 1959.

Hydrodynamic gas bearing designs are described. Working parameters are established and given. (T.R.H.)

6393

IMPROVEMENTS IN WATER-TUBE STEAM BOILERS. Andre Huet and Myron T. Herrick. British Patent 822,417. Oct. 28, 1959.

A boiler for use with nuclear reactors is described. The design includes a high-pressure boiler, a low-pressure boiler, economizer, superheater, and water–steam separator. Heat exchangers are arranged radially inside a large

cylindrical casing with axes parallel to that of the casing. These smaller units can be prefabricated and assembled on site to facilitate construction. These elements can be connected to a central feed tank or to headers connected to a feed tank. The water tubes are finned, and each has an inner tube for hot liquid with steam and water flowing in the annular space. Other configurations and variations are pointed out. (T.R.H.)

6394

IMPROVEMENTS IN OR RELATING TO GLANDLESS SHAFT DRIVE TRANSMISSION SYSTEMS. George Oliver Jackson (to United Kingdom Atomic Energy Authority). British Patent 826,513. Jan. 13, 1960.

A drive transmission for closed systems is described in which the seal of the closed system is assured by a glandless arrangement. The drive shaft operates a crank which moves a gear wheel. The internal gears on the wheel engage external gears on the output shaft. A bellows and the crank-gear arrangement prevent backflow of fluid from the sealed region. (T.R.H.)

Heat Transfer and Fluid Flow

6395 AERE-M-538

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A BOILING-WATER RIG FOR DEMONSTRATION PURPOSES. H. Bowes. Sept. 1959. 33p. BIS.

A training rig is described for investigating boiling and non-boiling heat transfer to water flowing vertically upwards in an internally heated annulus. Theory and experimental practice is outlined, together with a practical description of design and construction which incorporates a test length for visual examination of various boiling phenomena. (auth)

6396 AERE-R-2996

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HEAT TRANSFER IN BEDS OF FLUIDISED PARTICLES: A LITERATURE SURVEY. H. Bannister. Oct. 1959. 64p. BIS.

A review is given of the literature of heat transfer in fluid beds with particular emphasis on gas supported systems since these are of greater industrial importance at present. Some mention is, however, made of liquid fluidization. The period covered is approximately 1940–59. (auth)

6397 CF-59-9-68

Oak Ridge National Lab., Tenn.

NOTES ON HEAT TRANSFER IN THE ORR CORE AT POWERS GREATER THAN 20 Mw. J. F. Wett, Jr. Sept. 22, 1959. 12p. OTS.

One of the problems being considered in anticipation of raising the power of the ORR is the possibility of nucleate boiling due to excessive heat fluxes. An attempt is made to analyze some of the worst conditions of a known core along with extrapolations to higher powers. (W.L.H.)

6398 HW-61738

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

COMPUTATIONAL AIDS FOR ESTIMATING PERFORMANCE OF LIQUID TO BOILING WATER HEAT EXCHANGERS. W. J. Love. Sept. 1, 1959. 17p. OTS.

Heat transfer equations for liquid to boiling water heat exchangers are presented. Charts of terminal $q/A-\Delta T$ are included to permit rapid variation of the liquid and boiling side heat transfer coefficients in the general surface area equations for transfer at 10^4 to 10^6 Btu/sq ft/hr. These may be used to investigate the effects of errors in boiling and liquid film coefficients. (J.R.D.)

6399 LWS-24654

California Research and Development Co., Livermore, Calif.

TABLE OF COOLANT PROPERTIES. W. S. Scheib, Jr. Jan. 9, 1953. Decl. Nov. 24, 1959. 6p. (CRD-R-11). OTS.

Tables are presented of physical, chemical, and nuclear properties for a number of metallic and non-metallic materials considered for use as reactor coolants. A number of materials which probably have no use as coolants are included for comparison purposes. The materials are evaluated with respect to cost and possible alloys with U or Pu to form liquid fuels or liquid fertile materials. Several other comparison criteria are included. (J.R.D.)

6400 NAA-SR-Memo-2179

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRESSURE DROP THROUGH THE REACTOR PRESSURE VESSEL. J. E. Gingrich. Oct. 1, 1957. 9p. OTS.

The pressure drop through the OMR pressure vessel was calculated to be 17.2 psi when using two primary coolant loops of 14-inch schedule 40 pipe and 14.2 psi when 16-inch schedule 40 pipes replace the 14-inch pipes. The results show that the largest single pressure drop through the pressure vessel occurs at the entrances to the outlet pipes. (W.D.M.)

6401 NAA-SR-Memo-4508

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THERMAL CONDUCTIVITY OF SNAP MATERIALS. R. A. Barney. Oct. 15, 1959. 15p. OTS.

Several classical techniques for the determination of thermal conductivity were reviewed and evaluated. On the basis of this survey, it appears that a transient radial heat flow method is most suitable for the materials to be examined. The ultimate accuracy is not expected to be better than ±5% with about 1% precision. (auth)

6402 NASA-TR-R-56

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

GRAPHICAL PRESENTATION OF DIFFERENCE SOLUTIONS FOR TRANSIENT RADIAL HEAT CONDUCTION IN HOLLOW CYLINDERS WITH HEAT TRANSFER AT THE INNER RADIUS AND FINITE SLABS WITH HEAT TRANSFER AT ONE BOUNDARY. James E. Hatch, Ralph L. Schacht, Lynn U. Albers, and Paul G. Saper. 1960. 59p.

Nondimensional temperature distributions for transient radial heat conduction through hollow cylinders and one-dimensional heat conduction in slabs of finite thickness are presented in graphical form for a range of heat input. The solutions are for radial heat conduction with heat transfer at the inner radius or slab heat conduction with heat transfer at one boundary. In both types of conduction it is assumed that the boundary opposite the heat-transfer surface is thermally insulated. The radial solutions cover a range of dimensionless radius ratios. The material is assumed to be homogeneous, and the physical properties are considered invariant with temperature. (auth)

6403 NP-8268

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

EFFECTS OF A MAGNETIC FIELD ON THE HYPERVE-

LOCITY FLOW ABOUT A BLUNT BODY. Richard W. Ziemer. Aug. 27, 1958. 24p. Contract AF04(647)-165. (GM-TR-0165-00464).

An experimental investigation was made of the effect of an applied magnetic field on the bow shock of a blunt body in hypervelocity air flow. Quantitative measurements of the stand-off distance were made in a three-inch electromagnetic shock tube with free-stream velocities up to 22,000 fps. The test body was a hemispherical cylinder containing a coaxial pulsed magnet coil in the nose which produced field strengths at the stagnation point of up to 40 kilogauss. The application of the magnetic field displaced the bow shock upstream and the stand-off distance increased by a factor of 7.5 for the condition ($\sigma B_b^2 r_b / \rho_\infty U$) = 69. The experimental results were compared with theory and good agreement was obtained within the range of experimental conditions. (auth)

6404 NP-8271

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

MAGNETOHYDRODYNAMIC-HYPERSONIC FLOW IN THE QUASI—NEWTONIAN APPROXIMATION. Rudolf X. Meyer. May 21, 1959. 14p. Contract AF04(647)-309. (TR-59-0000-00690).

The theory of the quasi-Newtonian approximation to magnetohydrodynamic flow is developed. Results are presented concerning the flow of an ionized gas in the shock layer of a re-entry body. A similarity solution, valid for arbitrarily varying conductivity, is obtained for a circular cone at zero angle of attack. (auth)

6405 NP-8275

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

ON THE LAMINAR COMPRESSIBLE BOUNDARY LAYER IN THE PRESENCE OF AN APPLIED MAGNETIC FIELD. William B. Bush. Oct. 2, 1959. 44p. Contract AF04 (647)-309. (TR-59-0000-00668).

A modified Stewartson transformation is applied to the laminar compressible magnetoaerodynamic boundary layer equations and the requirement of similarity is introduced, resulting in a set of ordinary nonlinear differential equations. In addition to the now familiar fluid mechanical requirements for similarity of the system concerning density, viscosity, wall temperature, Prandtl number, and free stream velocity distribution, it is necessary to meet certain requirements as to the electrical conductivity distribution through the boundary layer and the intensity of the component of the magnetic field acting normal to the direction of flow. The system of differential equations is solved by digital computation using finite difference techniques (line relaxation) for (1) the pressure gradient corresponding to that for an axisymmetric stagnation point ($\beta = 0.5$) and the infinitely favorable pressure gradient ($\beta = 2.0$); (2) the wall total enthalpy to free stream enthalpy ratio much less than one; (3) the electrical conductivity ratio proportional to various powers of the total enthalpy ratio; and (4) varying strengths of the component of the magnetic field normal to the flow. (auth)

6406 ORO-228

North Carolina State Coll., Raleigh.

A CORRELATION OF PULSE COLUMN LIQUID-LIQUID HEAT TRANSFER. Progress Report No. 23 [on] THE PERFORMANCE OF CONTACTORS FOR LIQUID-LIQUID EXTRACTION. William Berdell Barlage, Jr. and Frederick Philips Pike. Oct. 23, 1959. 270p. Contract AT(40-1)-1320. OTS.

Submitted as a thesis by William Berdell Barlage, Jr.

Heat transfer studies were refined and extended to the point where the results could be generalized into a mathematical correlation valid over a reasonably wide range of variables. An extended study was made of the rate of heat transfer between benzene and water in direct contact in a pulse column, and of the operating variables which controlled the behavior. In this mode of heat transfer the benzene was dispersed as a family of droplets into the water, which formed the continuous phase. The pulse column was 1.92-in. in inside diam., and contained 8 stainless steel perforated plates spaced 2.00 inches apart. The plates were perforated with 1/8-in. holes in a triangular 60° pattern, providing 24.6 per cent free area. The equipment was carefully insulated and modified in many details in order to permit precise heat transfer measurements. The operating conditions were varied so as to provide wide ranges of variables and heat transfer responses. (W.L.H.)

6407 SC-4370(RR)

Sandia Corp., Albuquerque, N. Mex.

A METHOD OF CALCULATING BOUNDARY-LAYER THICKNESS IN AXISYMMETRIC NOZZLES WITH LAMINAR HYPERSONIC FLOW. Arlo F. Johnson. Oct. 1959. 23p. OTS.

Excellent agreement between measured boundary layer thickness and thickness calculated by the Sivells and Payne method for turbulent boundary layer growth in axisymmetric hypersonic nozzles was determined. The method was applied to the condition of a laminar boundary layer problem. Calculations of displacement thickness at the exit of a Mach 6 nozzle are contained. (auth)

6408 WADC-TR-57-753

Minnesota. Univ., Minneapolis. Heat Transfer Lab.

CALCULATION OF CONVECTION HEAT TRANSFER TO NON-ISOTHERMAL SURFACES EXPOSED TO A FLUID STREAM WITH WEDGE TYPE SURFACE PRESSURE GRADIENT. J. P. Hartnett, E. R. G. Eckert, and Roland Birkebak. July 1958. 41p. Project No. 1366. Contract AF33(616)-3038. OTS. (AD-142236).

A single design procedure is developed for the calculation of local and total heat transfer rates from non-isothermal surfaces with prescribed wall temperature distributions. The method is initially developed for laminar wedge-type flows and for turbulent flow with zero pressure gradient. An extension of the method to cover heat transfer from non-isothermal surfaces with arbitrary pressure gradient is proposed. A solution for the inverse problem of calculating the wall temperature distribution along surfaces with a prescribed heat flow distribution is also presented for laminar wedge-type flows and for turbulent flow with zero pressure gradient. Examples are presented to illustrate the proposed methods. (auth)

6409 RAE-Lib-Trans-747

ON THE THEORY OF BORDA'S MOUTHPIECE FOR A GAS. (K Teorii Nasadka Borda Dlya Gaza). Ya. I. Sekerzh-Zen'kovich. Translated by W. T. Lord from Priklad. Mat. i Mekan. 21, 850-5(1957). 11p. (AD-204670).

The extension to a subsonic gas of the two-dimensional incompressible fluid flow known as Borda's mouthpiece is given. Formulae are given for the contraction coefficient and the boundary shape of the free jet in terms of γ (the ratio of the specific heats of the gas) and the constant velocity on the boundary of the jet. The contraction coefficient is calculated for $\gamma = 3/2, 7/5, 4/3$ and the corresponding ranges of subsonic jet velocity, while boundary shapes are presented for $\gamma = 7/5$ and three values of jet velocity. (auth)

6410 RAE-Lib/Trans-750

FINITE DIFFERENCE METHOD FOR CALCULATING TRANSIENT TEMPERATURE DISTRIBUTIONS DUE TO ONE DIMENSIONAL HEAT FLOW IN SIMPLE AND COMPOSITE BODIES. (Differenzenverfahren zum Berechnen von Temperatur-Ausgleichs-Vorgaengen bei Eindimensionaler Waermestroemung in Einfachen und Zusammengesetzten Koerpern). Herbert Schuh. Translated by K. E. Bücks from VDI-Forschungsheft No. 459, 43p., Suppl. to Forsch. Gebiete Ingenieurw. Vol. 23B (1957). 78p.

The finite difference method is improved upon so that transient temperature distributions may be found due to heat flow which takes place normal or parallel to the surfaces of thick plates and thin-walled bodies of high conductance, respectively. Simple and composite bodies can be treated. The stability of solutions, discontinuities in the initial and boundary conditions, as well as other details are extensively dealt with. The computational work connected with the finite difference method increases with the third power of the number of sections into which the body is divided. Hence, it is essential, in view of practical applications, to keep the number of sections as small as possible in order to reach the required accuracy. Sufficiently accurate solutions can be obtained with quite a small number of sections by a suitable method of satisfying boundary conditions and other precautions. It appears often more convenient to deal with composite bodies by replacing them by a series of individual reservoirs and heat resistances; rules are given for simplifying such arrangements so that the computational work is kept within reasonable limits. The use of high speed electronic calculating machines for solving finite difference equations is discussed. Three examples of composite bodies are treated in detail to demonstrate the application of the method. (auth)

6411 UCRL-Trans-515

PRELIMINARY CONSIDERATION ON THE MERCURY FLOW IN THE MERCURY CHLORINE CELL (PART 1) PURE MERCURY FLOW IN THE NON OPERATED CELL. Sugino Toshiyuki. Translated for Univ. of California Radiation Lab. from Denki Kagaku Zasshi 20, 495-502(1952). 27p. (Includes orig. 8p.). JCL.

The behavior of pure mercury in inoperative chlorine cells was investigated to determine flow characteristics. Experimental results are used as an aid to a theoretical flow approximation for mercury containing no sodium. The effects of sodium on surface tension and contact angle are discussed in a second report. (J.R.D.)

6412

CONTRIBUTION TO THE THEORY OF MASS AND HEAT TRANSFER IN A TURBULENT MEDIUM. V. Kolář (Inst. of Chemical Tech., Prague). Collection Czechoslov. Chem. Communs. 24, 3811-15(1959) Dec.

On the basis of the concepts of the statistical theory of turbulence, a relation was derived for the rate of mass transfer which gives a single valued correspondence between the hydrodynamical relations characterized by the local degree of turbulence λ_0 and the rate of the process. Further, a relation was derived for the hydraulic efficiency of a unit in which mass or heat transfer occurs. (auth)

6413

HEAT EXCHANGE BETWEEN A LIQUID AND A HEAT-EVOLVING ROD. V. I. Merkulov (Kiev State Univ.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 9, 985-90(1959). (In Ukrainian)

The paper gives a solution of the problem of stationary heat exchange between the plane stream of an ideal liquid and a heat-evolving cylinder. The temperatures in the rod and the liquid are represented by series obtained from functions which satisfy the equation. Unknown coefficients are determined from the equality of temperatures and heat flows on the rod boundary. (auth)

6414

A METHOD OF CALCULATING THE HEATING OF POLYDISPERSE SMALL-GRAINED MATERIAL IN A SUSPENSION. G. L. Babukha and M. M. Nazarchuk (Inst. of Thermal Power Engineering, Academy of Sciences, Kiev). Inzhener.-Fiz. Zhur. Akad. Nauk Belorus. S.S.R. 2, No. 10, 3-9(1959) Oct. (In Russian)

A method is outlined for calculating the heating of a polydisperse material moving in a tube in one direction with gas. This method makes it possible to calculate the change in physical constants of the gas and coefficients of heat exchange according to the length of the flow, and also the change of rate of movement of particles of the material. Results are given of a concrete calculation according to this method. (auth)

6415

THE INVESTIGATION OF HEAT TRANSFER DURING BOILING OF WATER AND ETHYL ALCOHOL IN PIPES. L. S. Sterman, V. G. Morozov, and S. A. Kovalev (Koshinhanovskii Inst. of Power Engineering, Central Inst. for Boilers and Turbines, Moscow Branch). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 10, 40-5(1959) Oct. (In Russian)

An investigation is made of heat transfer to water boiling at a pressure of from 27 to ~90 atm. The process of steam formation takes place while the medium is being forced through a vertical pipe 16 mm. in diameter. In these same conditions experiments were conducted with boiling ethyl alcohol at a pressure of 2 atm. The investigation was carried out by boiling in a stainless steel pipe heated by an electric current. The thermal resistance of the wall of the pipe was determined by three different methods. The experimental data obtained are worked out in a generalized criterial relationship. Considerable data published in recent years by other investigators were also worked out in this relationship. It is shown that the generalized critical relationship obtained earlier satisfactorily describes heat exchange where there is directed movement of the medium. (auth)

6416

HEAT TRANSFER DURING TRANSITION FLOW OF LIQUID METALS IN PIPES. V. M. Deryugin and O. S. Fedynskii (Kozhezhanovskii Inst. of Power Engineering, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 3-10(1959) Dec. (In Russian)

The "visual wetting" effect on heat transfer to liquid metals in a transition pipe flow is proved experimentally. The abrupt change in the heat transfer rate takes place at the hydrodynamic crisis (Re ≈ 2300) when the surface of the heat exchanger is wet, but does not take place when wetting is absent. Empirical equations for non-wetting conditions and for wetting conditions are recommended for calculation of the average heat transfer coefficients in direct pipes ($l/d \geq 70$). The local heat transfer coefficients at all points outside the inlet region of the test section are equal to the average coefficients when $l/d \geq 70$, and the inlet conditions are shown. For an estimation of the local heat transfer in the inlet region, special monograms may be used. When $Re < 50$, the values of the average heat transfer coefficients cannot be calculated on the basis of the equation $Nu = 0.7\ Re^{1/2}$, which has been

recommended, as it leads to serious exaggeration of the heat transfer rate. (auth)

6417

HEAT TRANSFER TO A TURBULENT FLOW OF LIQUID METAL WHERE HEAT LOAD IS DISTRIBUTED SINUSOIDALLY ALONG THE LENGTH OF THE PIPE. V. I. Petrovichev and L. S. Kokorev (Inst. of Engineering Physics, Inst. of Thermophysics, Siberian Branch, Academy of Sciences, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 20-24(1959) Dec. (In Russian)

The distribution of a thermal load along the length of a pipe wall has a considerable effect on the distribution of local coefficients of heat exchange if the heat transfer medium has a Prandtl number $\ll 1$. This conclusion also follows qualitatively from general considerations, since for liquid metal, because of its high "molecular" heat conductivity, boundary conditions will have a noticeable effect on the temperature field and will, consequently, be reflected in the values of local coefficients of heat exchange. A distribution of local Nu numbers along the length of the pipe is found for a sinusoidal distribution of heat load on the wall of a round pipe, with turbulent flow of liquid metal and Pr number 0.025, for Re numbers 10×10^3, 50×10^3, and 100×10^3, and length/diameter ratios of 44.6, 67, and 100. The dimensionless coefficient of heat exchange Nu falls over the whole length of the pipe, but the greatest change in Nu is at the two ends of the pipe. When the temperature of the wall reaches a maximum in a section of the pipe, the coefficient of heat transfer is somewhat less than the value obtained from the formula $q_{CT} = \text{const}$. This difference is greater for small Re numbers and length/diameter ratios, and decreases with an increase in Re numbers and length/diameter ratio. The position of the temperature maximum on the wall shifts somewhat along the flow of the transfer medium by comparison with results from the formula $q_{CT} = \text{const}$. This shift is greater for large Re numbers and for smaller length/diameter ratios. (auth)

6418

ATOMIC RECOMBINATION IN A HYPERSONIC WIND-TUNNEL NOZZLE. K. N. C. Bray (Univ. of Southampton, Eng.). J. Fluid Mech. 6, 1-32(1959) July.

The flow of an ideal dissociating gas through a nearly conical nozzle is considered. The equations of one-dimensional motion are solved numerically assuming a simple rate equation together with a number of different values for the rate constant. These calculations suggest that deviations from chemical equilibrium will occur in the nozzle if the rate constant lies within a very wide range of values, and that, once such a deviation has begun, the gas will very rapidly "freeze." The dissociation fraction will then remain almost constant if the flow is expanded further, or even if it passes through a constant area section. An approximate method of solution, making use of this property of sudden "freezing" of the flow, was developed and applied to the problem of estimating the deviations from equilibrium under a wide range of conditions. If all the assumptions made are accepted, then lack of chemical equilibrium may be expected in the working sections of hypersonic wind tunnels and shock tubes. The shape of an optimum nozzle is derived in order to minimize this departure from equilibrium. It is shown that, while the test section conditions are greatly affected by "freezing," the flow behind a normal shock wave is only changed slightly. The heat transfer rate and drag of a blunt body are estimated to be reduced by only about 25% even if complete freezing occurs. However, the shock wave shape is shown to be rather more sensitive to departures from equilibrium. (auth)

6419

THE MAGNETOHYDRODYNAMIC FLOW PAST A FLAT PLATE. H. P. Greenspan and G. F. Carrier (Harvard Univ., Cambridge, Mass.). J. Fluid Mech. 6, 77-96(1959) July.

The flow of a viscous, incompressible, electrically conducting fluid of constant properties past a semi-infinite rigid plate is considered. The applied magnetic field is uniform and directed in the free-stream direction (parallel to the plane of the plate). For magnetohydrodynamic flow past a flat plate it is shown that for any non-zero conductivity there is a single critical applied magnetic field for which the velocity and magnetic field at any field point are zero. No steady "subsonic" flow ($U_\infty <$ Alfvén speed) past an infinite plate (flow being uniform at infinity) can exist. A steady flow past a finite plate at $\beta < 1 < \beta$ exists. When $\beta > 1$, the upstream influence is much stronger than when $\beta < 1$. The structure of the upstream velocity profile for $\beta > 1$ is like that of the laminar wake when no magnetic field is present. The problems were treated by a direct extension of the asymptotic method which leads to the classical Blasius result and the modified Oseen technique. (C.J.G.)

6420

THE RISE OF A GAS BUBBLE IN A VISCOUS LIQUID. D. W. Moore (Univ. of Bristol, Eng.). J. Fluid Mech. 6, 113-30(1959) July.

The rise of a gas bubble in a viscous liquid at high Reynolds number is investigated. It being shown that in this case the irrotational solution for the flow past the bubble gives a uniform approximation to the velocity field. The drag force experienced by the bubble is calculated on this hypothesis and the drag coefficent is found to be $32/R$, where R is the Reynolds number (based on diameter) of the bubbles rising motion. This result is shown to be in fair agreement with experiment. The theory is extended to non-spherical bubbles and the relation of the resulting theory, which enables both bubble shape and velocity of rise to be predicted, to experiment is discussed. An inviscid model of the spherical cap bubble involving separated flow is considered. (auth)

6421

PERFORMANCE OF A PULSED HEAT EXCHANGER. L. K. Doraiswamy and N. B. Patel (National Chemical Lab., Poona, India). J. Sci. Ind. Research (India) 18A, 522-6(1959) Nov.

Data are reported on the effect of pulsations on heat transfer efficiency. Employing three heat exchangers the values for the overall heat transfer coefficient have been obtained over a wide range of Reynolds numbers and at frequencies of 40, 81, and 160 cycles/min, the pulses being damped to various degrees at each of the frequencies. The results show that pulsations can be used to improve heat transfer coefficients. (auth)

6422

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER SYSTEMS. Louis Afzal Husain (to United Kingdom Atomic Energy Authority). British Patent 817,963. Aug. 6, 1959.

A fuel element configuration with improved heat transfer is described. It has transverse radial fins surmounted by a continuous helical baffle. (T.R.H.)

Instrumentation

6423 AD-219295

Stanford Research Inst., Menlo Park, Calif.

OBTAINING A SYSTEM OF DOSIMETRY. Progress Report No. 12 [for] July 28 to September 27, 1958. S. I. Taimuty. Nov. 5, 1958. 17p. SRI Project No. SU-1946. Contract DA-19-129-QM-766.

Progress is reported in the development of a continuous monitor for use at a gamma irradiation facility for processing food packages. The monitoring system will give an immediate indication of the absorbed dose at every point in the package undergoing irradiation. Results are also reported from feasibility experiments with a stacked Al foil electron beam energy monitor. Measurements of response at electron energies ranging from 7 to 26 Mev indicate that the technique can provide a sensitive indication of changes in electron energy which are adequate for production monitoring purposes. (C.H.)

6424 AECU-4567

Evans Research and Development Corp., New York.

LETTER REPORT FOR NOVEMBER 15 TO DECEMBER 14, 1959 ON BETA-RAY PARTICLE SIZE ANALYZER. Eric J. Hewitt. Dec. 16, 1959. 3p. Contract AT(30-1)-2372. OTS.

Progress is reported on the development of a beta-ray particle size analyzer (BPSA). A system for automatically recording counts over an extended period of time was constructed. This system was used to obtain the necessary data for the calculation of significant count means and standard deviations with a variety of situations in the BPSA. (W.L.H.)

6425 AECU-4588

California Inst. of Tech., Pasadena. W. K. Kellogg Lab. of Radiation.

PRESENT STATUS OF SEMICONDUCTOR PARTICLE COUNTERS. C. A. Barnes. Nov. 23, 1959. 8p. Sponsored by ONR and AEC under Contract Nonr-220(18). OTS.

Some of the salient features of semiconductor particle counters are reviewed. The semiconductor particle detector shows great promise as a high-resolution, fast-rise-time particle detector for low-energy nuclear physics. The facts that no window is required, and that no expensive high-voltage supply is needed, represent distinct advantages of these counters. In addition their small size means less scattering of associated radiations. (W.L.H.)

6426 AERE-I/R-1527

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ABSOLUTE RADIOACTIVITY MEASUREMENTS WITH 4π GEIGER MÜLLER COUNTERS. D. B. Smith. 1954. 23p.

The design and construction of 4π Geiger Mueller Counters, and the technique of absolute radioactivity measurements by beta-particle counting are discussed. Three sources of error are considered: The probability of obtaining one count for each beta-particle passing into the counter volume; Losses due to the absorption of beta-particles in the mounting foil; and Losses due to the self absorption of beta-particles in the crystals of the source. (auth)

6427 AFSWP-1145

New York Naval Shipyard. Material Lab., Brooklyn.

A PROPOSED METHOD FOR MEASURING THERMAL DIFFUSIVITY AT ELEVATED TEMPERATURES. Final Report. A. Hirschman, W. L. Derksen, and T. I. Monahan. Apr. 30, 1959. 13p. (NML-5046-3(Pt. 119)).

A method was proposed for the measurement of thermal diffusivity of solids as a function of temperature at elevated temperatures. The method consists of generating a temperature oscillation on one face of a finite solid and measuring the phase difference between this oscillation and that which results on the other face. The specimen in the form of a thin disk will be irradiated on one face by chopped radiation in a carbon-arc image furnace. This will result in a steady axial temperature distribution with a small amplitude temperature oscillation superimposed. The phase difference between the fundamental components of the oscillations at both faces will be measured. This phase difference is a function of the diffusivity, frequency of oscillation and thickness of specimen. (auth)

6428 ANL-6079

Argonne National Lab., Lemont, Ill.

MANIPULATOR CABLE WITH CONSTANT STRESS (thesis). John H. Grimson. Nov. 1959. 44p. Contract W-31-109-eng-38. OTS.

Submitted to Northwestern Univ.

A manipulator or mechanical arm involves an upper arm and a lower arm, with a variable angle between them. Cables used to transmit motion and force from the upper to the lower arms pass over a pulley at the joint or elbow. A pulley, axially fixed with respect to the joint, imposes a change in length of the cable as the angle between the arms varies. Manipulation design requires a cable of constant length during this variation; this constant length may be achieved by guiding the center of the pulley along the proper path. Acceptable solutions were obtained in terms of variables such as the lengths of each arm, the radius of the pulley, and the angle between the arms. In one design the pulley center is moved along a straight line with respect to the lower arm, while in the other solution the pulley center is moved along a circular arc with respect to the upper arm. Practical and economical mechanisms based on these solutions were investigated for use in manipulator design. (auth)

6429 ARF-1152-6

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

AN IMPROVED NUCLEAR DENSITY GAUGE. Quarterly Report No. 2 Covering Period September 1 to December 1, 1959. G. M. Burgwald. 11p. Contract AT(11-1)-745. OTS.

Techniques for improving stability of scintillation counter chopper systems and their development for use in industrial control applications are being investigated. Tests are being performed to determine the causes of fluctuations. An integration and frequency converter is being developed in which the anode current of the photomultiplier tube is alternately switched between two integrating condensers by action of a commutator switch. The voltages developed across the two condensers are proportional to the respective intensities of the two radiation beams seen by the scintillation counter. Selective sampling by the use of Ross filters is scheduled for future investigations and a literature search on counter stabilization is also planned. (J.R.D.)

6430 CEA-1337

France. Commissariat à l'Énergie Atomique, Paris.

SONE A RESISTANCE POUR L-HYDROGÈNE LIQUIDE. (Resistance Probe for Liquid Hydrogen). J.-J. Beauval. 1959. 6p.

A simple device for determining the level of a liquid in equilibrium with its vapor is described. It makes use of the variation in heat exchange between a filament heated by a current and the atmosphere, on passing from the liquid to the gas. This apparatus is used to measure liquid hydrogen levels in Dewar vessels. (auth)

6431 GAT-T-726

Goodyear Atomic Corp., Portsmouth, Ohio.

ION PUMP FOR THE LINE RECORDER MASS SPECTROMETER. P. I. Davis and C. H. Eubank. Jan. 15, 1960. 7p. Contract AT(33-2)-1. OTS.

The adaptation of ion pumps for use in line recorder mass spectrometer systems, thus replacing mercury diffusion pumps, is reported. Quick pump-out and high vacuum were achieved, and after normal calibration, the line recorder conformed to accepted operating standards. Performance data and data on modification costs are included. (J.R.D.)

6432 HW-62386

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A ROTATING SOURCE FOR CALIBRATION PURPOSES. L. F. Kocher. Oct. 19, 1959. 5p. Contract AT(45-1)-1350. OTS.

A remotely operated system developed to transport (raise and lower) a ½ gram radium gamma radiation source for calibration of the HAPO film badges and finger rings is described. The system employs the rotometer principle for positioning the source for operating purposes. An accurate timer is utilized to assure the desired exposure time. (auth)

6433 JEN-65-DF/C-1

Spain. Junta de Energia Nuclear, Madrid.

DETECTORES DE RADIACIONES NUCLEARES. (Detection of Nuclear Radiations). Agustin Tanarro Sanz. 1959. 61p.

The lectures given on radiation detection instruments are summarized. The detectors discussed are ionization chambers, proportional counters, Geiger counters, scintillation detectors, and neutron detectors. The characteristics which must be considered in the design of associated electronic equipment are emphasized. (J.S.R.)

6434 NAA-SR-Memo-4654

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SUMMARY OF PROGRESS ON SPECIFIC HEAT MEASUREMENTS FOR ZIRCONIUM HYDRIDE. W. J. Tomasch. Nov. 20, 1959. 20p. OTS.

Calorimetric methods for investigating the specific heats of zirconium hydride and deuteride are examined. The merits of various measurement devices are discussed, and a pulsed adiabatic shield design was chosen for its accuracy, dependability, and ability to detect anomalies of small specific entropy. Performance tests using copper are described along with preliminary measurements of zirconium hydride. Sample encapsulation is described and plans for future work are given. (J.R.D.)

6435 NP-8211

Australia. National Standards Lab., Chippendale, New South Wales.

DIVISION OF ELECTROTECHNOLOGY ANNUAL REPORT FOR 1958–59. 33p.

The Division of Electrotechnology is responsible for the maintenance of the Commonwealth standards of measurement of electrical and magnetic quantities. The Division undertakes electrical and magnetic measurements on materials and the calibration of instruments and equipment. Research activities are summarized in direct current, power frequency, audio and radio frequency, magnetics, and dielectrics. (W.D.M.)

6436 NP-8248

Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

ESCALIMETRO DE 1 MICROSEGUNDO. Informe No. 12. (Scaler of 1 Microsecond. Report No. 12). Ricardo Gayoso. 1959. 26p.

A fast scaler, composed of a discriminator, pulse shaper, one microsecond decade, three 30 μsec decades, and a recorder, is described. Its resolution time is better than 1 μsec, and its maximum repetitive frequency is 100 kc/sec. The discrimination range is between 1 and 100 v. (auth)

6437 NP-8282

Israel Inst. of Tech., Haifa.

A SELECTED AREA LAUE BACK-REFLECTION X-RAY CAMERA AND PROCEDURE. Scientific Note No. 2. P. S. Rudman and B. Weiss. Aug. 1959. 7p. Contract AF61 (052)-122.

A simple Laue back-reflection x-ray camera and procedure for obtaining the orientation and/or structure of microscopically selectable areas of 0.5 mm diameter are described. (auth)

6438 NP-8284

Lockheed Nuclear Products, Marietta, Ga.

A HOLLOW PLASTIC BETA SPECTROMETER. K. E. Mears and W. M. Cole. Nov. 1959. 29p. Contract AF33(600)-38947. (NR-73).

The performance of hollow plastic scintillators fabricated for beta-ray spectroscopy is described. Also, the method employed in determination of the maximum beta-ray energy (transition energy) of Cs^{137}, Tl^{204}, Sr^{90}, and Y^{90} is presented. A discussion of distortions in Fermi plots is included. Results indicate that this type of spectrometer may be useful in identification of unknown beta emitters. (J.R.D.)

6439 NP-8286

Lockheed Nuclear Products, Marietta, Ga.

LOCKHEED AREA MONITORING SYSTEM. E. N. Lide, L. A. Turner, R. L. Shipp, and S. K. Stephenson. Dec. 1959. 60p. Contracts AF33(600)-32055 and AF33(600)-38947. (NR-78).

A unique system for monitoring radiological hazards was developed to obtain data at remote locations and transfer the information over long distances to a central station. In this system, a single, inexpensive twin lead is run from the central recording station to each remote station. Each twin lead carries primary power and channel selecting signals from the central to its associated remote station and carries radiation analog signals from the remote station back to the central station for recording. All remote instrumentation is transistorized, with the exception of two electrometer tubes and buried underground to minimize temperature variations. (auth)

6440 SC-2974(TR)

Sandia Corp., Albuquerque, N. Mex.

A PHOTOETCHING TECHNIQUE FOR THE PRECISION FABRICATION OF WAVEGUIDE ANTENNA ARRAYS. B. J. Bittner and E. J. Wilkinson. Sept. 28, 1953. Changed from OFFICIAL USE ONLY Apr. 1, 1955. 13p. OTS.

The adaptability of a photo-etching technique to x-band antennas was studied. A number of slot configurations were photoetched on a copper-clad laminate, and antennas were constructed by replacing a broad wall of a piece of 1 by 0.5 by 0.05 in. waveguide with one of the etched sheets.

The use of Teflon fiber-glass laminate assures an all-weather seal for the slotted antenna. (auth)

6441 SCTM-262-59(15)
Sandia Corp., Albuquerque, N. Mex.
A TUTORIAL SURVEY OF INFORMATION STORAGE DEVICES. Owen K. Skousen. Sept. 14, 1959. 64p. OTS.

A tutorial survey of information storage techniques and systems (both digital and analog) suitable for use in computer memories is presented. Although conventional storage schemes (magnetic tape and core memories) are presented, the primary concern of this paper is to acquaint the reader with those devices and techniques that are little known or of recent development. For example, the report describes Curie-point writing on magnetic films, radiation magnetization of magnetic cores, analog storage in magnetic cores, cryogenic and spin-echo memory devices, along with others. (auth)

6442 SCTM-295-59(16)
Sandia Corp., Albuquerque, N. Mex.
A SATURATED SALT SOLUTION HYGROMETER CALIBRATION SYSTEM. J. L. Chamberlin. Dec. 7, 1959. 10p. OTS.

A hygrometer calibration system employing saturated salt solutions to maintain a constant relative humidity and a dew-point indicator was developed. An evaluation at 26.7°C for saturated salt solutions of lithium chloride, potassium acetate, potassium fluoride, magnesium chloride, potassium carbonate, sodium dichromate, sodium bromide, sodium chloride, sodium nitrate, ammonium sulfate, and potassium nitrate indicated that the calibration system had an accuracy better than one percentage point of relative humidity for all the salts tested except potassium nitrate. (auth)

6443 SCTM-342-59(52)
Sandia Corp., Albuquerque, N. Mex.
TEMPERATURE-MEASURING THERMISTORS FOR 5-VOLT TELEMETERING SYSTEMS. Oct. 27, 1959. 11p. OTS.

Performance tests are presented of four types of temperature-measuring thermistors. The tests were conducted to determine their adaptability to a 5-volt telemetering system. Results indicate that precise temperature measurements are possible with proper associated circuitry. (auth)

6444 USNRDL-TR-369
Naval Radiological Defense Lab., San Francisco.
A WIND-MEASURING SYSTEM FOR THE TACTICAL PREDICTION OF FALLOUT. A. D. Anderson. Oct. 15, 1959. 39p.

A system that is capable of obtaining accurate wind measurements in the region of the atmosphere where fall-out is occurring is essential for the tactical prediction of fall-out. Such a system must include a vehicle to deliver wind-sounding targets rapidly to pertinent locations in the atmosphere, and an adequate tracking system that makes the wind data available immediately. Since current meteorological sounding equipment cannot meet these requirements, a new wind-measuring system is proposed that uses radar to measure the drift of falling passive targets delivered by rockets or gun projectiles. It appears feasible to develop an optimum system that can provide both accurate wind data and the associated fall-out-area prediction for a region of interest within 10 min after a nuclear burst. (auth)

6445 WADC-TR-57-434
Stanford Research Inst., Menlo Park, Calif.
ELECTRON TUBES FOR CRITICAL ENVIRONMENTS. Walter H. Kohl and Philip Rice. Nov. 20, 1957. 223p. Project title: ELECTRONIC TUBES AND TRANSISTORS. Contract AF33(616)-3460. (AD-151158).

A literature search of material published prior to November 20, 1957, was made on the design of electron tubes for operation at temperatures up to 500°C at high levels of shock, vibration, and nuclear radiation. The materials and techniques that enter into electron tube design are examined, and the effects of high temperature are analyzed. Radiation damage in the tube materials is described. (C.J.G.)

6446 WCAP-6037
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. SUMMARY AND PROGRESS REPORT TO DECEMBER 31, 1959. Dec. 31, 1959. 91p. Contract AT(30-1)-2176. OTS.

Activities on a Nuclear Materials Control System are summarized. In June of 1959, the AEC undertook a critical re-evaluation of the over-all research and development needs of its safeguards program for source and special nuclear materials. This re-evaluation resulted in the termination of most work programs in the NMCR Project. Terminal reports on these programs have either been issued or are in preparation. Experimental work is continuing on a N^{16} monitor for measuring reactor power and coolant flow rate, and on the development of non-destructive assay techniques for reactor fuel elements. Chemistry and chemical engineering studies, nuclear studies, special devices, and security devices and techniques are discussed. (For preceding period see WCAP-6015.) (W.D.M.)

6447 AEC-tr-3948
AN IMPROVED ELECTROLYTIC TANK. Joseph Himpan. Translated by Gretchen Riese (Los Alamos Scientific Lab.) from Elektrotech. Z. 63, 349-51(1942). 14p. JCL.

Electric fields defined by even complicated electrode configurations can be measured with the help of the electrolytic tank. Knowledge of these fields is often important in both weak and strong field techniques. An electrolytic tank is described which in practice can meet high requirements for simplicity and measurement precision. In particular the construction and electrical arrangement of the tank are discussed in detail and practical field plots made with it are interpreted. (auth)

6448 AERE-Trans-843
A SENSITIVE LUMINESCENT X-RAY DOSIMETER INDEPENDENT OF WAVELENGTH. E. Krokowski. Translated by S. Fitzgerald (Atomic Energy Research Establishment) from Z. Naturforsch. 14b, 304-6(1959). 9p.

This paper was previously abstracted from the original language and appears in NSA, Volume 13, as abstract no. 15324.

6449 CEA-tr-R-761
MÉTHODE DE COMPTAGE ABSOLU DES PARTICULES CHARGÉES. (Method for the Absolute Counting of Charged Particles). S. A. Baranov and R. M. Polevoi. Translated into French from Pribory i Tekh. Ekspt. No. 3, 32-6(1957). 14p.

A method is given for calibration of standard installations with Geiger-Mueller counter tubes ordinarily used for β-counting. A 4π flow counter of simple construction and stable in operation is described which can make absolute α and β and fission fragment measurements. The electronic scheme of the instrument is given, and experiments are described which verify a 100% efficiency in charged particle counting. (tr-auth)

6450
AN IDENTIFICATION INDEX FOR 100-μ TRACKS IN PHOTONUCLEAR EMULSIONS. F. Senent, E. Villar, R. Font, L. Miralles, A. García, and J. Catalá (Instituto de Optica "Daza de Valdés," Valencia, Spain). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55, 251-62 (1959) Sept.-Oct. (In Spanish)

For short-track identification in nuclear emulsions, a new index was used which was independent of the emulsion processing: the mean curvature radius of the track, calculated after changing the actual trajectory, with all its irregularities, by an average line. It has been obtained with two different types of cells and enables us to discriminate protons, deuterons and α-particles of a 100-μ range with good statistics. (auth)

6451
RESTORATION OF THE THICKNESS OF PHOTONUCLEAR EMULSIONS BY TREATMENT WITH A COLOPHANE RESIN. J. Catalá and J. Casanova (Instituto de Optica "Daza de Valdés," Valencia, Spain). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55, 263-6(1959) Sept.-Oct. (In Spanish)

The swelling of nuclear emulsions after processing was investigated using an alcoholic dissolution of colophane resin. The variation of the final thickness with the resin concentration and the immersion time was also studied. (auth)

6452
EFFECTS OF TEMPERATURE ON PHOTOMULTIPLIERS. M. Lontie-Bailliez and A. Meessen (Université, Louvain, Belg.). Ann. soc. sci. Bruxelles, Ser. I 73, 390-402(1959). (In French)

The temperature dependency of photocathode and dynode efficiency has been measured separately at 6000, 5500, 5000 and 4500 A. Combining this with all known results, a curve was plotted for the wavelength dependency of the $SbCs_3$ photocathode temperature coefficient, from 2500 to 7000 A. This coefficient changes sign at 5500 A. It is of the order of $-0.25\%/°C$ for $\lambda \leq 5000$ A but rises sharply for $\lambda \geq 5500$ A. The dynodes always have a negative temperature coefficient, fluctuating around $-0.40\%/°C$. This can be understood by the decrease of surface charges when the temperature of the semiconductor rises. (auth)

6453
MAGNETIC ANALYZER FOR 12-Mev DEUTERONS. A. Gonze (Université, Louvain, Belg.). Ann. soc. sci. Bruxelles, Ser. I 73, 414-19(1959). (In French)

A brief description is given of the principal characteristics of a magnetic analyzer attached to the 12-Mev cyclotron of the Institut de Physique Nucleaire de l'Université de Louvain. It gives a 55° deviation of the deuteron beam. (tr-auth)

6454
CONIC POLARIMETER FOR GAMMA RAYS; MEASUREMENT OF THE CORRELATION OF BETA–GAMMA CIRCULAR POLARIZATION OF Au^{198}. J. P. Deutsch and P. Lipnik (Université, Louvain, Belg.). Ann. soc. sci. Bruxelles, Ser. I 73, 420-31(1959). (In French)

A new-type non-cylindrical device for measurement of gamma-ray circular polarization is presented. A figure of merit is computed to compare different polarimetric devices. The developed polarimeter seems to present high merit except in the very low energy region (E < 300 kev) where Steffen-type polarimeters are to be preferred. Preliminary results of beta–gamma circular polarization correlation measurements on Au^{198} are presented. The value $A = 0.45 \pm 0.11$ obtained agrees with other results in the field. (auth)

6455
THE USE OF THERMISTORS FOR THE MEASUREMENT OF LOW PRESSURES. M. Varicak and B. Saftic (Inst. of Physics, Rudjer Boskovic Inst., Zagreb). Automazione e automatismi No. 2, 4p. (1959) Mar.-Apr. (In Italian)

A brief résumé is given of experiments made on the use of thermistors for the measurement of low pressures. These experiments led to the construction of a manometer with a pressure range 1 to 10^{-4} mm Hg. The method used for the compensation of ambient temperatures is described. The electrical circuit is discussed, and a block diagram is given. The results of test performances of the manometer are presented and discussed. (J.S.R.)

6456
CALIBRATION OF A MEASUREMENT DEVICE FOR AIRBORNE RADIOACTIVITY. A. Becker, Y. Le Gallic, and M. Thenard. Bull. inform. sci. et tech. (Paris) No. 33, 2-11(1959) Oct. (In French)

A determination was made of the responses of a GM detecting device to α, β, γ radiations, the scope being the simple application of the method in the case of regular measurements on numerous samples with similar devices, with a convenient accuracy. An evaluation of self absorption of emitted radiations in the case of paper filters impregnated by atmospheric air passing through the filters was also made. The results are applied to the thoron series for which a detailed decay scheme is given; the method leads to an accurate relation between registered pulses and the expression of the concentrations in curies. The results are also applied to the case of fission products for which the lack of knowledge of details of decay series allows but an experimental correspondence necessarily arbitrary to be established between registered pulses and concentrations in curies. (auth)

6457
DETECTION OF NUCLEAR PARTICLES BY MEANS OF SEMI-CONDUCTORS. R. Bomal. Bull. inform. sci. et tech. (Paris) No. 34, 2-12(1959) Nov. (In French)

After recalling the basic properties of semi-conductors and np junctions, the results are given of a study made on characteristics of various photodiodes (conduction band, response time, background and avalanches). The possibilities of nuclear particle detection with np junctions and various semi-conductors are determined in view of the detection of individual particles, of the dosimetry of a particle flux, and of the direct conversion of nuclear energy into electricity. With a Ge junction diffused with Sb, an energy resolution of 4% for α rays of 5.3 MeV (Po^{210}) was obtained. Resolutions of 2% may be obtained at the liquid nitrogen temperature with Ge junctions diffused with gold. A small βγ dosimeter using as detector a AsGa junction has been developed. The sensibility threshold of this instrument is 10^4 R/h. Presently, the use of energy converters in the μW-mW range can be considered. Those converters are actually long lived electric piles operating at temperatures as high as 70-80°C. (auth)

6458
RECENT ADVANCES IN SCINTILLATION COUNTERS. Yves Koechlin. Bull. inform. sci. et tech. (Paris) No. 34, 13-21(1959) Nov. (In French)

Scintillation counters have allowed since the beginning

a great variety of measurements due to the flexibility of their use. Numerous improvements have been made and they have presently a prominent place among radiation detectors. It is shown how, by technical improvements, in both laboratory and industry, the scintillation counter has become an instrument currently used in the field of nuclear research. (auth)

6459

TWO-CRYSTAL SCINTILLATION SPECTROMETER WITH PULSE SUMMATION. Josef Kajfosz and Jiří Kopecký (Inst. of Nuclear Physics, Czechoslovak Academy of Science, Prague). Czechoslov. J. Phys. 8, 574-82(1958). (In Russian)

A description is given of a γ-ray scintillation spectrometer, working on the principle of the summation of pulse amplitudes from two detectors. The radiation from the source being tested must fall on the crystals of both detectors, which are located near one another. To detect radiation of given energy E_γ those photons are used which cause the Compton effect in one of the two crystals and the scattered quantum is absorbed in the second crystal by the photo-effect. In this case the amplitude of the pulse from the first detector is proportional to the energy of the scattered photon, which is $E_\gamma - E_e$. By electric summation of the amplitudes of both pulses we obtain a pulse having a final amplitude E_γ. The advantages of the summation spectrometer are thus the great efficiency in a broad energy region with simultaneous preservation of good resolution and the linearity of the spectrum. These properties, together with the great purity of the spectrum, give summation spectrometers priority over other types of multicrystal spectrometers. (auth)

6460

EFFICIENCY OF SCINTILLATION COUNTERS FOR FAST NEUTRONS. František Lehar (Inst. f. Kernphysik der Tschechosl. A.d.W., Prague). Czechoslov. J. Phys. 8, 586-91(1958). (In Russian)

A study of the preparation and efficiency measurement of scintillators for fast neutrons is described. The scintillators were prepared by dispersing ZnS(Ag) in paraffin, polymethylmethacrylate, and polystyrene. These scintillators have a sufficiently high efficiency for fast neutrons, and also a low efficiency for gamma rays. An RCA 6199 photomultiplier was used. (T.R.H.)

6461

BASIC RELATIONS FOR PROPOSING MECHANICAL NEUTRON SELECTORS. Jaromir Juna (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 592-9(1958). (In Russian)

Relations are derived for calculating the physical parameters of mechanical neutron selectors. After transforming the equations of motion of the neutron into a system of rotor coordinates, an approximate equation of the trajectory of the neutron in the rotor is derived. From this equation there follows relations between the radius of the rotor, the rate of the revolutions, the geometric and effective width of the slit, the curvature of the slit and the maximum flight distance at which all the channels of the analyzer are still used. A relation is derived from the geometric conditions for an approximate estimate of the luminosity of the instrument. (auth)

6462

HOW RADIATION MONITOR GUARDS NUCLEAR NAVY. H. E. DeBolt (Fairchild Camera and Instrument Corp., Syosset, N. Y.). Electronics 33, No. 4, 43-5(1960) Jan. 22.

The design of a transistorized monitor sensitive to alpha and beta radiation concentrations in the range 8×10^{-10} to 8×10^{-7} μc/cc is described. The system pumps air from the compartment being monitored and passes it through a filter paper where it is examined by a scintillation counter. If the radiation level exceeds predetermined levels, both visual and audible alarm signals are produced. (C.J.G.)

6463

MULTIPLEX CIRCUITS FOR CONTROL OF A ROBOT. D. A. Campbell (Hughes Aircraft Co., Los Angeles). Electronics 33, No. 4, 46-8(1960) Jan. 22.

A description is given of the control circuits for the Mark I robot. A digital control system with synchronous commutating switches (each switch has 54 contacts) is used. Remote switching and switch synchronizing are discussed. The automatic synchronizing circuit consists of a motor interrupter and a synchronism sensing circuit. (C.J.G.)

6464

APPARATUS FOR THE DETERMINATION OF THE BAND ABSORPTION OF GASES AT ELEVATED PRESSURES AND TEMPERATURES. J. T. Bevans, R. V. Dunkle, D. K. Edwards, J. T. Gier, L. L. Levenson, and A. K. Oppenheim (Univ. of California, Berkeley). J. Opt. Soc. Am. 50, 130-4 (1960) Feb.

Apparatus for the measurement of the band absorption of gases at pressures up to 10 atm and temperatures up to 1400°K is described. An optical path of 15 in. is maintained with an accuracy of 1% by a nozzle seal system which allows measurements to be made without the use of windows in the high temperature zone. Use of KBr windows for the pressure seal permits measurements to 23 μ. (auth)

6465

THE DETERMINATION OF LATTICE DISTANCES AND THE INTENSITY CORRECTION OF X-RAY DIFFRACTIONS ON A GONIOMETER USING GEIGER-MÜLLER COUNTERS. František Khol. Materiálový Sborník, 361-7(1958). (In Czech.)

A recording goniometer was devised to intercept the individual x-ray diffractions upon the lattices of the specimen by means of Geiger-Müller counters. Using a Seemann-Bohlin focusing adjustment, a vertical correction diaphragm was installed which permits correction of the intensities of the individual distances according to the variable distances. The direct reading of lattice distances is made possible, hence the indications of the goniometer can be evaluated by the operator without carrying out difficult calculations. (auth)

6466

RESONANCE FLUX MEASUREMENT WITH ACTIVATION PROBES. Wolfgang Männer and Tasso Springer (Technische Hochschule, München). Nukleonik 1, 337-41(1959) Dec. (In German)

For the absolute estimation of the resonance neutron flux by the activation of resonance probes, it is necessary to know the neutron self-screening in the probe in thick probes and in beta counting to know the magnitude of the beta self-absorption. For the determination of these magnitudes a function is calculated which gives the resonance activation as a function of the depth of penetration. It was experimentally proved on measurements with indium. The self-absorption factor was compared with the results of previous investigations. (tr-auth)

6467

COINCIDENCE COUNTING WITH SCINTILLATION

COUNTERS. H. S. Murdoch and K. W. Ogilvie (Univ. of Sydney). Nuovo cimento (10) 14, 661-72(1959) Nov. 16. (In English)

An examination is made of the factors affecting the coincidence technique when scintillation counters are used. Approximate expressions for the distribution of random time delays due to the photomultipliers are employed to derive the dependence of the so called prompt and delayed counting rates upon the inserted delay especially when this is small. Comparison with experiment shows that these expressions are applicable in many cases. The choice of optimum resolving time is treated, and the characteristics of coincidence circuits discussed. (auth)

6468

SELF-CONTAINED MEASURING EQUIPMENT FOR ELECTRON DENSITY AND IONIC MASS SPECTRUM. J. Sayers (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London), A 253, 522-5(1959) Dec. 29.

Experiments are reviewed in which satellite instrumentation was used in the measurement of electron densities and ionic mass spectra in the upper atmosphere. The electron density instrumentation was flown successfully at the Woomera range in June 1958. The electron density was measured by the detection of changes in the dielectric constant of the space occupied by free electrons not influenced by a magnetic field. The mass spectrometer was specially devised for upper atmosphere measurement. Resolving power is sacrificed in favor of a very large aperture (1000 cm^2). This instrument is expected to be able to detect small proportions of certain ion types in the main distribution which may play an important part in ionic processes. (B.O.G.)

6469

CAVITY CHAMBER THEORY. W. C. Roesch (General Electric Co., Richland, Wash.). Radiology 74, 109-10 (1960) Jan.

The relation of the absorbed radiation dose in the cavity wall of an ionization chamber to the energy absorbed per unit mass in the cavity material is discussed. A simplification is presented of the cavity chamber theory. (C.H.)

6470

RECOMBINATION LOSS IN IONIZATION CHAMBERS IN A PULSED BEAM. Robert Loevinger (Stanford Univ., Calif.). Radiology 74, 110-11(1960) Jan.

Ionization chamber recombination loss is discussed for a pulsed beam from a linear electron accelerator having a repetition rate of 60 pulses per second and a pulse length of one microsecond, giving a peak-to-average current ratio of greater than 10^4. A modified equation is presented for use in formulation of an approximate theory for ionization chamber recombination loss in a pulsed beam. (C.H.)

6471

OSCILLOSCOPIC DISPLAY OF RELATIVISTIC ELECTRON BEAMS. L. E. Tsopp. Radiotekh. i Elektron. 4, 1936-8(1959) Nov. (In Russian)

The oscilloscopic display of a relativistic electron beam of 0.5 ± 0.02 Mev was studied with a double-slit resonator. The loading efficiency of the resonator was raised to 200. Pulse power of 20 to 30 kv with 10 cm range was placed into the cavity at 15 cm from the resonator to the fluorescent screen, and the deflection beam amplitude was up to 60 mm with a light spot diameter of 1.5 mm. Work was initiated to develop resonators with annular electron beam scanning with energies up to 5 Mev with 100 to 150 mm diameter. (R.V.J.)

6472

A RADIOCARBON DATING SYSTEM USING SCINTILLATION TECHNIQUES. C. F. G. Delaney and I. R. McAulay. Sci. Proc. Roy. Dublin Soc. 1, No. 1, 1-20(1959) Dec. 2.

The development of a radiocarbon dating system using scintillation techniques is described. The sample to be dated is converted to methyl alcohol, and mixed with a liquid scintillator. The scintillator cell is of fused silica, in the form of a cylinder of volume 50 ml, 10 ml of methanol being added to 40 ml of liquid scintillator. The scintillator cell is viewed by two photomultipliers operating in coincidence. The background counting rate is reduced by massive screening and by pulse height selection. The net contemporary carbon counting rate is 20.6 cpm above a background counting rate of 13.6 cpm. Using a seventeen hour counting period, this system can give results of significance to 30,000 years. A discussion of the chemical synthesis is given, and some results are presented. (auth)

6473

AUTOMATIC RECORDING OF THE DISTRIBUTION OF RADIOISOTOPES IN THE BODY. Rudolf Prüg (Siemens-Reiniger-Werke AG, Erlangen, Ger.). Strahlentherapie 110, 559-71(1959) Dec. (In German)

Considering the low gamma-ray intensities available, in scintiscanning, or automatic recording of the radioactive isotope distribution in the human organism, optimum adaptation of all factors affecting the quality of the scintigrams is imperative. Therefore, ways have been studied to attain an utmost reduction of the scanning times and the activities applied, at unchanged quality of the scintigrams preferably by proper choice of the collimator set-up and the dimensions of the scintillation crystal. It became evident that with medium crystal and collimator dimensions in all cases most favorable conditions are obtained. Too small dimensions require an extremely long scanning time, too large dimensions do not give sufficient contrast, thus limiting the possible maximum scanning speed. Moreover, the image-scale reduction as a further time-saving factor has been incorporated in the Siemens Nucleograph in addition to the mentioned features. (auth)

6474

MEASUREMENT OF SOME (n,γ) SPECTRA WITH A PAIR SPECTROMETER OF HIGH SENSITIVITY. H. Knoepfel, P. Scherrer, and P. Stoll (Eidgenossische Technische Hochschule, Zurich). Z. Physik 156, 293-317(1959). (In German)

A pair spectrometer of the 180°-focusing type with high efficiency and good resolution is described. The efficiency was determined as a function of the energy both theoretically and experimentally, and it is possible, therefore, to use this spectrometer for absolute calibration of gamma rays above 2.5 Mev. The evaluation methods of the pair spectra allow the single line to be determined with an error as little as ±8 kev (from 2.5 to 9 Mev). The neutron capture gamma spectrum of I^{127}, Cs^{133}, $Ir^{191,193}$, and Bi^{209} were measured, and the energy and intensity of the resolved gamma rays were given. From these results it is possible to compute the binding energy of the last neutron and also some unknown levels. The experiments, which were performed in connection with the pair spectrometer, have shown an interesting possibility for research work with reactors. With an appropriate experimental arrangement and some special neutron capture gamma spectra, monochromatic gamma rays in the energy range

between 3 and 11 Mev are obtained, which are better and much more intense than corresponding gamma rays from (p,γ) reactions. (auth)

6475

IMPROVEMENTS IN OR RELATING TO MOLECULAR BEAM DEVICES. Arnold Hugh William Beck, John Lytollis, and Edward Thomas Eyre. (to Standard Telephones and Cables Ltd.). British Patent 817,600. Aug. 6, 1959.

A molecular beam source is described which is suitable for use with Na or Cs. The vapor is generated in a glass vessel which is then sealed off. The vapor passes through a heated glass tube to a metal chamber with a collimator and slit. (T.R.H.)

6476

NEUTRON DETECTOR. (to United Kingdom Atomic Energy Authority). British Patent 817,753. Aug. 6, 1959.

A thermocouple neutron flux detector for reactor control systems is offered. The junctions are arranged on a lavite, soap-stone, or Lucite bridge and covered with a boron-containing lacquer. Other coatings containing U^{235}, Ag, or Cd may be used. The means of preparing the thermocouple detector, the lacquer, and the circuit arrangement are described. (T.R.H.)

6477

IMPROVEMENTS IN OR RELATING TO INTEGRATING CIRCUITS. Edmund Harry Cooke-Yarborough (to United Kingdom Atomic Energy Authority). British Patent 818,104. Aug. 12, 1959.

A pulse integrating circuit is described. It has a feed condenser and a storage condenser which are charged in series through the control grid-cathode path of the first tube of a d-c amplifier during pulses. The feed condenser is discharged after each pulse and the storage condenser is part of a negative feedback connection for the amplifier between pulses. Thus the storage condenser receives a constant charge increment during each pulse and the output voltage of the amplifier is the voltage across the storage condenser. One side of the storage condenser is connected to the control grid of the first tube of the d-c amplifier, and the other side is connected through a resistive impedance to the amplifier output. The feed condenser is connected between input and the side of the storage condenser away from the input grid. (T.R.H.)

6478

IMPROVEMENTS IN DOSIMETER CHARGING DEVICES. Thomas Desmond Hudson Andrews and Warren Hayward (to Dowty Nucleonics, Ltd.). British Patent 818,569. Aug. 19, 1959.

A mechanical device which facilitates the charging of pocket dosimeters is described. It has a lever arrangement which compresses the charging pin of the dosimeter allowing the operator greater freedom for the other manipulations. (T.R.H.)

6479

ION SOURCES. (to United Kingdom Atomic Energy Authority). British Patent 818,671. Aug. 19, 1959.

An ion source which produces positive ions from solid U halides is described. The anode chamber leads to the arc chamber with its loop cathode and screen. The arc slit has accelerating electrodes. (T.R.H.)

6480

IMPROVEMENTS IN FISSION PRODUCT DETECTION SYSTEMS. Gordon Vernon Hough and Denis Aliaga Kelly (to Plessey Company Ltd.). British Patent 818,685. Aug. 19, 1959.

A fuel element rupture detection system is described which is based on detection of the solids from gaseous fission product decay. Decay solids are precipitated from the coolant gas on a negative electrode by a radial electrostatic field. The electrode is withdrawn at suitable intervals to a counting chamber. A shielded proportional counter here measures beta activity of the electrode and alternately of an extension of the electrode. The difference of these measurements represents solid fission product activity. (T.R.H.)

6481

IMPROVEMENTS IN OR RELATING TO A HAND GRIP DEVICE FOR THE OPERATION OF REMOTE HANDLING MECHANISMS. Donald Orr (to United Kingdom Atomic Energy Authority). British Patent 825,552. Dec. 16, 1959.

A handle for a remote manipulating device is described. The handle provides for moving a long rod in a tube or fixing its position at a desired place. (T.R.H.)

6482

IMPROVEMENTS IN OR RELATING TO REMOTE HANDLING MECHANISMS. Donald Orr (to United Kingdom Atomic Energy Authority). British Patent 825,553. Dec. 16, 1959.

An adaptor for the grip device described in patent No. 825,552 is described which will make it possible to operate several different tools with one handle. (T.R.H.)

6483

IMPROVEMENTS RELATING TO NUCLEAR REACTORS. George Camac (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 825,662. Dec. 16, 1959.

A liquid-CO_2 operated servo device for opening and closing reactor fuel channels is described. The exhausted CO_2 can be discharged to the reactor cooling system. (T.R.H.)

6484

IMPROVEMENTS IN OR RELATING TO SPARK-GAP CIRCUITS. Richard Anthony Fitch (to United Kingdom Atomic Energy Authority). British Patent 826,071. Dec. 23, 1959.

A spark-gap circuit is described which is useful in discharging a number of parallel-connected condensers through a gas discharge tube. The condensers are connected to the discharge tube through spark gaps by means of coaxial cables of length such that the source voltage is delayed more than $\frac{1}{2}$ the maximum breakdown times of the gaps. The spark gaps have irradiating electrodes connected through low-capacity condensers to a master spark gap. This master spark gap is so connected that it triggers the others to discharge the condenser bank simultaneously. (T.R.H.)

6485

REACTOR CONTROL DEVICE. H. B. Kaufman and A. A. Weiss (to U. S. Atomic Energy Commission). U. S. Patent 2,900,316. Aug. 18, 1959.

A shadow control device for controlling a nuclear reactor is described. The device comprises a series of hollow neutron-absorbing elements arranged in groups, each element having a cavity for substantially housing an adjoining element and a longitudinal member for commonly supporting the groups of elements. Longitudinal actuation of the longitudinal member distributes the elements along its entire length in which position maximum worth is achieved.

6486

FAST NEUTRON SPECTROMETER. F. J. Davis, G. S.

Hurst, and P. W. Reinhardt (to U. S. Atomic Energy Commission). U. S. Patent 2,900,516. Aug. 18, 1959.

An improved proton recoil spectrometer for determining the energy spectrum of a fast neutron beam is described. Instead of discriminating against and thereby "throwing away" the many recoil protons other than those traveling parallel to the neutron beam axis as do conventional spectrometers, this device utilizes protons scattered over a very wide solid angle. An ovoidal gas-filled recoil chamber is coated on the inside with a scintillator. The ovoidal shape of the sensitive portion of the wall defining the chamber conforms to the envelope of the range of the proton recoils from the radiator disposed within the chamber. A photomultiplier monitors the output of the scintillator, and a counter counts the pulses caused by protons of energy just sufficient to reach the scintillator.

6487

CONTINUOUSLY SENSITIVE BUBBLE CHAMBER. R. H. Good (to U. S. Atomic Energy Commission). U. S. Patent 2,900,518. Aug. 18, 1959.

A radiation detector of the bubble chamber class is described which is continuously sensitive and which does not require the complex pressure cycling equipment characteristic of prior forms of the chamber. The radiation sensitive element is a gas-saturated liquid and means are provided for establishing a thermal gradient across a region of the liquid. The gradient has a temperature range including both the saturation temperature of the liquid and more elevated temperatures. Thus a supersaturated zone is created in which ionizing radiations may give rise to visible gas bubbles indicative of the passage of the radiation through the liquid. Additional means are provided for replenishing the supply of gas-saturated liquid to maintain continuous sensitivity.

6488

APPARATUS FOR HANDLING MIXTURES OF SOLID MATERIALS. J. P. Hubbell (to U. S. Atomic Energy Commission). U. S. Patent 2,901,007. Aug. 25, 1959.

An apparatus is described for handling either a mixture of finely subdivided materials or a single material requiring a compacting action thereon preparatory to a chemical reducing process carried out in a crucible container. The apparatus is designed to deposit a mixture of dust-forming solid materials in a container while confining the materials against escape into the surrounding atmosphere. A movable filling tube, having a compacting member, is connected to the container and to a covered hopper receiving the mixture of materials. The filling tube is capable of reciprocating in the container and their relative positions are dependent upon the pressure established upon the material by the compacting member.

6489

ELECTRONIC MULTIPLIER CIRCUIT. R. E. Thomas (to U. S. Atomic Energy Commission). U. S. Patent 2,901,172. Aug. 25, 1959.

An electronic multiplier circuit is described in which an output voltage having an amplitude proportional to the product or quotient of the input signals is accomplished in a novel manner which facilitates simplicity of circuit construction and a high degree of accuracy in accomplishing the multiplying and dividing function. The circuit broadly comprises a multiplier tube in which the plate current is proportional to the voltage applied to a first control grid multiplied by the difference between voltage applied to a second control grid and the voltage applied to the first control grid. Means are provided to apply a first signal to be multiplied to the first control grid together with means for applying the sum of the first signal to be multiplied and a second signal to be multiplied to the second control grid whereby the plate current of the multiplier tube is proportional to the product of the first and second signals to be multiplied.

6490

DETECTOR FOR MODULATED AND UNMODULATED SIGNALS. H. H. Patterson and G. H. Webber (to U. S. Atomic Energy Commission). U. S. Patent 2,901,613. Aug. 25, 1959.

An r-f signal-detecting device is described, which is embodied in a compact coaxial circuit principally comprising a detecting crystal diode and a modulating crystal diode connected in parallel. Incoming modulated r-f signals are demodulated by the detecting crystal diode to furnish an audio input to an audio amplifier. The detecting diode will not, however, produce an audio signal from an unmodulated r-f signal. In order that unmodulated signals may be detected, such incoming signals have a locally produced audio signal superimposed on them at the modulating crystal diode and then the "induced or artificially modulated" signal is reflected toward the detecting diode which in the process of demodulation produces an audio signal for the audio amplifier.

6491

MASS SPECTROMETRY. A. O. C. Nier (to U. S. Atomic Energy Commission). U. S. Patent 2,901,624. Aug. 25, 1959.

A voltage switching apparatus is described for use with a mass spectrometer in the concentration analysis of several components of a gas mixture. The system automatically varies the voltage on the accelerating electrode of the mass spectrometer through a program of voltages which corresponds to the particular gas components under analysis. Automatic operation may be discontinued at any time to permit the operator to manually select any desired predetermined accelerating voltage. Further, the system may be manually adjusted to vary the accelerating voltage over a wide range.

6492

TRANSFORMER. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,901,714. Aug. 25, 1959.

Transformers of a type adapted for use with extreme high power vacuum tubes where current requirements may be of the order of 2,000 to 200,000 amperes are described. The transformer casing has the form of a re-entrant section being extended through an opening in one end of the cylinder to form a coaxial terminal arrangement. A toroidal multi-turn primary winding is disposed within the casing in coaxial relationship therein. In a second embodiment, means are provided for forming the casing as a multi-turn secondary. The transformer is characterized by minimized resistance heating, minimized external magnetic flux, and an economical construction.

6493

PHASE DETECTOR. D. O Kippenhan (to U. S. Atomic Energy Commission). U. S. Patent 2,903,581. Sept. 8, 1959.

A phase detector circuit is described for use at very high frequencies of the order of 50 megacycles. The detector circuit includes a pair of rectifiers inverted relative to each other. One voltage to be compared is applied to the two rectifiers in phase opposition and the other voltage to be compared is commonly applied to the two rectifiers. The two resulting d-c voltages derived from the rectifiers are combined in phase opposition to produce a single d-c voltage having amplitude and polarity charac-

teristics dependent upon the phase relation between the signals to be compared. Principal novelty resides in the employment of a half-wave transmission line to derive the phase opposing signals from the first voltage to be compared for application to the two rectifiers in place of the transformer commonly utilized for such purpose in phase detector circuits for operation at lower frequency.

6494

TAPERED DEFINING SLOT. F. W. Pressey (to U. S. Atomic Energy Commission). U. S. Patent 2,903,586. Sept. 8, 1959.

An improvement is reported in the shape and formation of the slot or opening in the collimating slot member which forms part of an ion source of the type wherein a vapor of the material to be ionized is bombarded by electrons in a magnetic field to strike an arc-producing ionization. The defining slot is formed so as to have a substantial taper away from the cathode, causing the electron bombardment from the cathode to be dispersed over a greater area reducing its temperature and at the same time bringing the principal concentration of heat from the electron bombardment nearer the anode side of the slot, thus reducing deterioration and prolonging the life of the slot member during operation.

6495

RISE TIME DELAY DISCRIMINATOR. C. W. Johnstone (to U. S. Atomic Energy Commission). U. S. Patent 2,906,872. Sept. 29, 1959.

A pulse-height discriminator for generating an output pulse when the accepted input pulse is approximately at its maximum value is described. A gating tube and a negative bias generator responsive to the derivative of the input pulse and means for impressing the output of the bias generator to at least one control electrode of the gating tube are included.

6496

IMPEDANCE ALARM SYSTEM. R. G. Cowen (to U. S. Atomic Energy Commission). U. S. Patent 2,907,017. Sept. 29, 1959.

A description is given of electric protective systems and burglar alarm systems of the capacitance type in which the approach of an intruder at a place to be protected varies the capacitance in an electric circuit and the change is thereafter communicated to a remote point to actuate an alarm. According to the invention, an astable transitor multi-vibrator has the amplitude at its output voltage controlled by a change in the sensing capacitance. The sensing capacitance is effectively connected between collector and base of one stage of the multivibrator circuit through the detector-to-monitor line. The output of the detector is a small d-c voltage across the detector-to-monitor line. This d-c voltage is amplified and monitored at the other end of the line, where an appropriate alarm is actuated if a sudden change in the voltage occurs. The present system has a high degree of sensitivity and is very difficult to defeat by known techniques.

6497

GROUND CLEARANCE INDICATOR. L. V. Skinner (to U. S. Atomic Energy Commission). U. S. Patent 2,907,023. Sept. 29, 1959.

A narrow-band frequency-modulated distance measuring system is described. Reflected wave energy is fed into a mixer circuit together with a direct wave energy portion from the transmitter. These two input signals are out of phase by an amount proportional to the distance. Two band pass filters select two different frequency components (both multiples of transmitter modulation frequency) from the beat frequency. These component frequencies are rectified and their voltage values, which are representative of those frequencies, are compared. It has been found that these voltages will have equal values producing a null output only when an object attains a preselected distance. The null output may be utilized to operate a normally closed relay, for example. At other ranges the voltage comparison will yield a voltage sufficient to keep the relay energized. Ranges may be changed by varying the degree of modulation of the transmitter carrier frequency. A particular advantage of this system lies in its high degree of accuracy throughout a range of distances approaching zero as a minimum.

Materials Testing

6498 IS-66

Ames Lab., Ames, Iowa.

AN AUTOGRAPHIC ELEVATED TEMPERATURE CREEP TESTING FACILITY. Robert L. Hammel and Robert E. Uhrig. [Nov. 17, 1959]. 22p. Contract W-7405-eng-82. OTS.

An apparatus for determining the elevated temperature creep properties of materials is described which provides an autographic strain record, reliable temperature control for both constant or programmed cyclic temperatures, and oxidation protection by means of specimen encapsulation. (auth)

6499 R53GL132

General Electric Co. General Engineering Lab., Schenectady, N. Y.

RADIOMETRIC FLAW DETECTOR. W. T. Gannon. June 29, 1953. Decl. Nov. 20, 1959. 22p. OTS.

A study of a radiometric method of detecting subsurface flaws in bonded aluminum cylinders was made. A prototype equipment using an electronic induction heater to heat the surface of a test cylinder and an infrared sensitive lead sulfide cell to detect surface thermal transients occasioned by subsurface flaws was developed. Small temperature differences on the surface of test cylinders having mean surface temperatures from 200 to 550°F could be detected. Major hot spots on the surface of some test cylinders were correlated with large subsurface flaws by subsequent destructive testing. (auth)

GEOLOGY, MINERALOGY, AND METEOROLOGY

6500 AECU-4626

Atlantic Research Corp., Alexandria, Va.

SAMPLING THE UPPER ATMOSPHERE FOR PARTICULATE MATTER. Quarterly Progress Report No. 1 [for] June 15 to September 25, 1959. Michael Markels, Jr. and John H. Morgenthaler. Nov. 1959. 26p. Contract AT(30-1)-2404. OTS.

An analysis to screen the various particle-collection systems which might be used for sampling the upper atmosphere with a rocket sampling vehicle has been undertaken. A range of altitudes from about 100,000 to 200,000 feet was considered. The difficulty in obtaining samples of the magnitude of 1,000 standard cubic feet of air in the altitude range considered is pointed out. Since the density of air decreases very rapidly above 100,000 feet, a new crite-

rion for sample size other than weight (or standard cubic feet) of air sampled appears necessary. A parachute which opens at maximum sampling altitude, and which acts as an air scoop, and also increases sampling time by limiting rate of descent is discussed. Particle collection methods showing some promise include thermal precipitation, electrostatic precipitation, use of the Goetz Aerosol Spectrometer, filtration, and impaction. The preliminary analysis indicates that a blowing action will probably be required with any of these methods to obtain a reasonable sample size. Although the current model of the Goetz Aerosol Spectrometer is not suitable, a high-flow-rate sampler of this general type, if it can be designed, appears promising. The design of such a sampler will be undertaken in future work. If a workable design is possible, this method would appear to be the most promising of all. (auth)

6501 AERE-R-3021

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NUCLEONIC INSTRUMENTATION FOR THE DETECTION AND ASSAY OF BERYLLIUM MINERALS. H. Bisby. Oct. 1959. 28p. BIS.

When beryllium minerals are irradiated with γ-radiation of suitable energy, photoneutrons are emitted, and a measurement of the neutron flux thus produced can be used to determine the beryllium content of the ore. Details of two instruments designed to support a geological program of surveying beryl deposits are given and other developments are described. (J.R.D.)

6502 BNL-578

Brookhaven National Lab., Upton, N. Y.

A STUDY OF THE WIND PROFILE IN THE LOWEST 400 FEET OF THE ATMOSPHERE. Progress Report No. 4 [for] June 15, 1959–October 15, 1959. Irving A. Singer and Gilbert S. Raynor. Oct. 1959. 13p. DA Project No. 3-99-07-306. Contract R-65-8-99812 SC-04-91. OTS.

Progress is reported in the collection of high-quality wind data. The analytical processes were checked for accuracy. Data are collected by the automatic data processing system and analyzed on an IBM 704 computer. Spectrum and spectral density of wind speed for the frequency range from 0.001 to 1000 cycles per hour were computed for 75 and 300 feet. (C.H.)

6503 SCTM-368-59(51)

Sandia Corp., Albuquerque, N. Mex.

ATMOSPHERIC DENSITY PROFILES TO 100 KILOMETERS. B. N. Charles. Nov. 13, 1959. 9p. OTS.

Data are reviewed to estimate likely variations of actual atmospheric density profiles from that of the ARDC 1956 Model Atmosphere. These estimates are preliminary as the available data for the upper 50 km are very limited at this time, but many additional observational data are expected to be released in the near future. Graphs and tables are presented showing estimated departures of density profiles at 30 and 60°N, for the summer and winter seasons, from the ARDC 1956 Model Atmosphere. (auth)

6504 WT-71(Del.)

Air Force Cambridge Research Center, Mass.

ATMOSPHERIC CONDUCTIVITY. Annex 4.6 [of] Scientific Director's Report of Atomic Weapon Tests at Eniwetok, 1951. OPERATION GREENHOUSE. Samuel C. Coroniti, G. R. Wait, and A. J. Parziale. Sept. 1951. 83p. OTS.

Data are presented from measurements of air conductivity and ion content of air within an atomic cloud, and measurements of air conductivity above the shot area and adjacent terrain. The rate and magnitude of fall-out and its relation to the direction and velocity of the wind were also measured. (C.H.)

6505 WT-1019

Scripps Institution of Oceanography, La Jolla, Calif.

PHYSICAL OCEANOGRAPHY OF THE TEST AREA. Paul L. Horrer. May 1955. Changed from OFFICIAL USE ONLY Sept. 19, 1959. 35p. Project 2.8 (Part II) [of] OPERATION WIGWAM.

The objectives of the project were the selection of a test site, to provide information for prediction of phenomenology, and to document the test with environmental information. Research cruises made to the general region during 1954 broadened available oceanographic knowledge about the area and enabled a tentative site selection and speculation on phenomenology. Final recommendations were based on oceanographic data collected in April 1955 and from 5 to 13 May 1955, just prior to the test. It was determined that contaminated waters moved westward from the test site at an average speed of about 0.1 knot (away from shore and fishing grounds), dispersion of radioactivity at a given level was relatively slow during the first 10 days, but vertical current shear augmented its spreading, depth of radioactivity measured at various times after the event appears intimately associated with stability or vertical density gradient in the water, and at H = 0 the array and most ships of the Task Group were over relatively flat sea bottom, but a ridge 0.75 mile high existed about 5 miles south of Ground Zero. The low current speeds and movements of water away from land and ocean fishing grounds at the test area were desirable conditions, and, from an oceanographic viewpoint, the area can be recommended for future tests of similar magnitude. (auth)

6506 CEA-tr-A-641

INEXACTITUDE ET "LIMITES D'ERREUR PERMISES" DANS LES ÉVALUATIONS DE RÉSERVES. (Inexactitude and "Permissible Limits of Error" in the Evaluation of Reserves). Friedrich Stammberger (Stamberger). Translated into French from Z. angew. Geol. 4, 180-9(1956). 35p.

A study was made to determine: what the unavoidable errors are in reserve calculations based on an accurate methodical geological prospection; what the amplitude of these errors are for the total result; and to what extent these measurements are manifest in different categories and whether one should neglect categories having "permissible" limits of error. (T.R.H.)

6507 CEA-tr-R-733

LE PROBLÈME DES RAPPORTS ENTRE LES PEGMATITES À MÉTAUX RARES ET CERTAINS TYPES DE GISEMENT FILONIENS. (The Problem of the Relation Between Pegmatites with Rare Metals and Certain Types of Deposits). A. I. Ginsburg (Guinsburg) and D. I. Gorzhevskii (Gorzevskyi). Translated into French from Izvest. Akad. Nauk S.S.S.R., Ser. Geol. No. 6, 14-29(1957). 35p.

A study was made of the relation between so-called rare-metal substituted pegmatites and pneumatolyto-hydrothermal formations (quartzous with cassiterite, wolfram, or molybdenite). It was concluded that the formation of pegmatites and the vein deposits in question is related to more complex intrusives and takes place at different depths according to two parallel and independent lines of development. Although the pneumatolytic-hydrothermal processes evolve later, the development of the pegmatic processes is in a certain case connected with earlier phases of complex intrusives. (tr-auth)

6508 SCL-T-284

PHYSICS OF THE LOWEST LAYER OF THE ATMOSPHERE AND THE ATMOSPHERIC TURBULENCE. (Fizika Prizemnogo Sloya Atmosfery i Atmosfernaya Turbulentnost'). Translated by Marcel I. Weinreich (Sandia Corp.) from p.48-51 (Chap. VI) of "Information on Scientific Studies on Meteorology." Committee on Geodesy & Geophysics. Academy of Sciences of the USSR. Presented at the International Association of Meteorology to the XIth Assembly of the International Geodetic & Geophysical Union, Moscow, 1957. (Komitet po Geodezii i Geofizike, Akademiia Nauk SSSR). 10p. JCL or LC.

Brief reviews of various aspects of ground layer turbulence, structure, and methods of forecasting are presented along with references related to each. 72 references. (J.R.D.)

6509

ISOTOPIC COMPOSITION OF LEAD ORES OF THE BALTIC SHIELD. A. P. Vinogradov, L. S. Tarasov, and S. I. Zykov (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Geokhimiya No. 7, 571-607(1959). (In Russian)

The isotopic composition of the galena lead and of the lead impurities from various ores of different genetic types and of different age from the whole territory of the Baltic shield was determined. All together about 100 samples were investigated. According to the isotopic lead composition two branches of leads stand out: the svekofennian and the karelian type. The svekofennian leads are more monotonous and are characteristic of higher values of all three isotopes with regard to Pb^{204} than the karelian leads. Besides leads corresponding to the age of their formation, a series of considerably more ancient leads than the ores and rocks including them was found. A graph is proposed for calculating the age of leads according to their isotopic composition based on ideas about the differentiation of terrestrial matter and empirical regularities of variations in the isotopic composition of synchronous leads. Some age groups of leads typical of the whole territory are singled out. Assumptions are made regarding the geological history of the shield on the basis of data on the isotopic compositions of leads. (auth)

6510

ISOTOPE Ar^{38} ACCUMULATION IN URANIUM MINERALS. E. K. Gerling and Yu. A. Shukolyukov (Lab. of the Precambrian Geology, Academy of Sciences, Leningrad). Geokhimiya No. 7, 608-18(1959). (In Russian)

The A^{38} content was investigated in 17 uranium minerals aged from 2×10^8 to 2×10^9 years. The content of U, Pb, He, Xe, and Cl was determined in the samples. Corrections for the A^{38} loss were made according to the data on the He and Xe losses. The calculated excessive quantity of A^{38} in minerals of the same age decreased with the increase of the Cl content which may be explained by the reaction $Cl^{35}(n\gamma)Cl^{36}\xrightarrow{\beta}A^{36}$. Corrections were made for A^{38} according to the quantities of radiogenic A^{36}. The earlier proposed nuclear reactions cannot explain the experimental data. There is a proportionality between the U content and the A^{38} content. Between the quantities of A^{38} and xenon of neutron fission (Xe_n) a dependence of the type $A^{38} = \alpha Xe_n + b$ was found. Samples were found which with a complete absence of Xe_n contain noticeable quantities of A^{38} ($A^{38} = b$). The possibility of an A^{38} formation from the spontaneous fission of U^{238} and the neutron fission of U^{235} was assumed. The A^{38} formation goes through the hypothetical radioactive isotope with $T_n = (690 \pm 230) \times 10^6$ years. The yield of the latter from U fission must be 3%. (auth)

6511

RADIOACTIVITY OF THE WATERS OF THE INDIAN OCEAN. V. I. Baranov and L. A. Kristianova (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Geokhimiya No. 7, 619-22(1959). (In Russian)

A direct determination of uranium content in some tens of water samples of the Indian Ocean was carried out. It is found that the uranium content in the central areas of the ocean is on the average 1.8×10^{-6} g/l. In the southwestern part, the content is somewhat higher (1.0×10^{-4} g/l). By calculation the concentration of thorium (1.0×10^{-6} g/l) and of ionium (6×10^{-13} g/l) in the central part of the ocean, where a distinct disturbance of the radioactive equilibrium is established in the uranium family with a considerable ionium deficiency compared to uranium was estimated. (auth)

6512

ON THE DISTRIBUTION OF SCANDIUM IN IGNEOUS ROCKS ON THE EXAMPLE OF SOME MASSIVES OF THE SOVIET UNION. L. F. Borisenko (Inst. of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements, Academy of Sciences, Moscow). Geokhimiya No. 7, 623-[illegible] (1959). (In Russian)

The results of an investigation of scandium distribution in a number of intrusive massives of the Soviet Union have shown that higher scandium contents are typical of ultrabasic and basic rocks (~0.003% of Sc_2O_3) and lower contents of intermediate (~0.0005 of Sc_2O_3) and acid rocks (~0.000[illegible] of Sc_2O_3). The character of FeO, MgO, and Sc_2O_3 distribution in rocks of the ultra basic type bears witness of a more probable geochemical bond of scandium and divalent iron. Pyroxenites are characterized by the highest Sc_2O_3 content (up to 0.017%). (auth)

6513

ON THE GEOCHEMISTRY OF RARE METAL PEGMATITES. N. A. Solodov (Inst. of Mineralogy, Geochemistry and Crystallochemistry of Rare Elements, Academy of Sciences, Moscow). Geokhimiya No. 7, 628-37(1959). (In Russian)

According to the rock-forming minerals, four types of rare-metal pegmatites are distinguished: type I—microcline pegmatites, type II—albite-microcline pegmatites, type III—albite pegmatites, and type IV—albite-spodumene pegmatites. The content of alkaline and rare elements in these types is not always similar, usually ranging in rather narrow limits in well developed veins of the same types. The following elements are characteristic of the different types: type I—K, Be; type II—K, Na, Ta, Be, Cs, Rb, Tl, and Li; type III—Na, Li, Be, Ta, Nb, and Sn; type IV—Na and Li, and sometimes Nb and Sn. The formation of the different types and the different degree of their enrichment by alkaline and rare elements may be explained by the initial geochemical specificity of the pegmatite melts. (auth)

6514

ON THE GEOCHEMISTRY OF NIOBIUM AND TANTALUM IN THE LOVOZERO ALKALINE MASSIF. V. I. Gerasimovskiĭ, M. M. Kakhana, L. M. Rodionova, and V. A. Venkina (Vernadskiĭ Inst. of Geochemistry and Analytical Chemistry, Moscow). Geokhimiya No. 7, 646-55(1959). (In Russian)

In the nepheline syenites of the Lovozero massif (Kola peninsula), niobium and tantalum are concentrated in minerals which contain titanium and zirconium and isomor-

phously replace these elements in them. In the formation process of rocks of the massif which, compared to other types of magmatic rocks, is enriched in niobium and tantalum, a separation of niobium from tantalum does not occur. The niobium/tantalum ratio for nepheline syenites is the same (~12) for different intrusive phases. An increase of tantalum with regard to niobium is even not observed in rocks being considerably enriched in zirconium. Towards the end of the magmatic process an accumulation of niobium and tantalum takes place; their relative concentration compared to titanium increases simultaneously. (auth)

6515

CONSTITUTION OF THE ATMOSPHERE AT IONOSPHERIC LEVELS. Marcel Nicolet (C.S.A.G.I., Ukkel, Belg.). J. Geophys. Research 64, 2092-2101(1958) Dec.

A description of the upper atmosphere is given and the factors governing the vertical distribution are discussed. The dissociation and recombination of molecular and atomic oxygen and nitrogen relative to distribution with height are discussed. The structure of the atmosphere deduced from density measurements is related to the variation of the mean molecular mass depending on diffusion effects. The effects of conduction on the heat budget are discussed. (auth)

6516

IONIZATIONS AND DRIFTS IN THE IONOSPHERE. J. A. Ratcliffe (Cambridge Univ., Eng.). J. Geophys. Research 64, 2102-11(1959) Dec.

A description of the vertical distribution and the horizontal irregularities and movements of electrons in the ionosphere is summarized. The mechanism by which electrons can be moved either by the movement of the surrounding air or by electric fields arising from charges elsewhere in the ionosphere is discussed. The statistical description of a randomly moving distribution function which is commonly used by investigators of the ionosphere is described. (auth)

6517

THE NATURAL OCCURRENCE OF TURBULENCE. R. W. Stewart (Univ. of British Columbia, Vancouver, Can.). J. Geophys. Research 64, 2112-15(1959) Dec.

A definition of turbulence is given. The natural occurrence of turbulence is discussed and it is inferred that, with the exception of strong inversion layers, the atmosphere may be assumed to be turbulent everywhere, although the intensity of the turbulence varies widely in both time and space. (C.J.G.)

6518

RADIO SCATTERING IN THE LOWER IONOSPHERE. H. G. Booker (Cornell Univ., Ithaca, N. Y.). J. Geophys. Research 64, 2164-77(1959) Dec.

Radio-scattering phenomena at the 80- to 90-km level observed in the frequency range 30 to 100 Mc indicate the presence of irregularities of electron density with scales in the range from 20 to 60 meters (corrugation wavelengths from 120 to 360 meters). The irregularities are approximately isotropic, and the scattered power is inversely proportional to about the sixth power of scale. The power law involved may vary somewhat with the state of the atmosphere. The fading of the radio waves is consistent with random motions of the irregularities with velocities of the order of 25 m/sec. Similar observations of the sporadic-E phenomena occurring at a height of about 110 km show that the scattered power is inversely proportional to something like the eighteenth power of scale while the velocity of irregularities, if interpreted as random, is around 5 m/sec. (auth)

6519

LARGE-SCALE MOVEMENTS OF IONIZATION IN THE IONOSPHERE. D. F. Martyn (Commonwealth Scientific and Industrial Research Organization, Camden, New South Wales, Australia). J. Geophys. Research 64, 2178-9(1959) Dec.

The complexity of the causes of variations in and motions of ionization in the ionosphere is noted, as is the difficulty of differentiating real and virtual motions. An instability mechanism for deviations in ionization density is suggested, for which the predicted temporal and spatial morphologies appear to be consistent with those of the occurrence of sporadic E, spread F, and radio-star scintillations. (auth)

6520

SCATTERING OF WAVES AND MICROSTRUCTURE OF TURBULENCE IN THE ATMOSPHERE. A. M. Oboukhov (Inst. of the Physics of the Atmosphere, Academy of Sciences, Moscow). J. Geophys. Research 64, 2180-7 (1959) Dec.

The theory of wave scattering by turbulent inhomogeneities is discussed and applied to the scattering phenomena of sound. The results of a study on the turbulent spectrum are compared with data from meteorological measurements in the surface layer. The method of scattered radio waves is applied to a study of turbulence in the ionosphere. (C.J.G.)

6521

EFFECT OF A MAGNETIC FIELD ON TURBULENCE IN AN IONIZED GAS. J. W. Dungey (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Geophys. Research 64, 2188-91(1959) Dec.

The problem of the effect of a magnetic field on turbulence in an ionized gas is formulated using the equations of motion for each constituent of the gas. Approximations are discussed, and idealizations are adopted appropriate to the ionosphere. A description is given of the generation of irregularities in electron density by shear flow in the neutral air. Given the motion of the air, the electron density can be calculated, and this calculation is carried out in the linear approximation for an arbitrary Fourier component. (auth)

6522

ON THE SPECTRUM OF ELECTRON DENSITY PRODUCED BY TURBULENCE IN THE IONOSPHERE IN THE PRESENCE OF A MAGNETIC FIELD. I. D. Howells (Cavendish Lab., Cambridge, Eng.). J. Geophys. Research 64, 2198-9(1959) Dec.

Utilizing Dungey's model, approximate equations are obtained for electron number density of ionization, under the action of turbulence, diffusion, and a magnetic field in the ionosphere. The principal result is that this mechanism cannot be expected to produce irregularities that are strongly elongated along the magnetic field. A form is obtained for the spectrum function of number density below 140 km. (auth)

6523

EVIDENCE OF ELONGATED IRREGULARITIES IN THE IONOSPHERE. B. Nichols (Cornell Univ., Ithaca, N. Y.). J. Geophys. Research 64, 2200-2(1959) Dec.

Radio observations of backscatter from ionospheric irregularities under both auroral and nonauroral conditions indicate the presence of small-scale irregularities, elongated along the earth's magnetic field. These elongated

irregularities were found at heights from 80 to 300 km. The most precise measurements are related to echoes from auroral ionization at a height of about 100 km. These indicate scales of tens of meters along the earth's magnetic field and tens of centimeters normal to the field. (auth)

6524

AN INTERPRETATION OF CERTAIN IONOSPHERIC MOTIONS IN TERMS OF ATMOSPHERIC WAVES. C. O. Hines (Defence Research Board, Ottawa). J. Geophys. Research 64, 2210-11(1959) Dec.

Internal atmospheric waves, subject to gravitational and compressional forces, have characteristics in close accord with measurements of ionospheric motions revealed by meteor trails. A correlation of the ionospheric motions in terms of atmospheric waves is presented. (auth)

6525

ON THE INFLUENCE OF THE MAGNETIC FIELD ON THE CHARACTER OF TURBULENCE IN THE IONOSPHERE. G. S. Golitsyn (Inst. of the Physics of the Atmosphere, Academy of Sciences, Moscow). J. Geophys. Research 64, 2212-14(1959) Dec.

The influence of the earth's magnetic field on the character of turbulence in the ionosphere is considered on the basis of the equations of magnetohydrodynamics. The estimates given show that its influence in the lower ionosphere up to heights of 150 to 200 km can be neglected. At heights greater than 200 km the influence of the earth's magnetic field must be considered in the dynamics of the medium. The fact that the gases are highly rarefied constitutes an additional problem in formulating a theory of turbulence for the upper regions of the ionosphere. It is shown that the ratio of Kolmogoroff's inner scale of turbulence to the mean free path of neutral molecules decreases with the decrease in number of particles n as $n^{1/4}$, reaching the value of the order 30 or less at the height of 250 km. Therefore, the theory of turbulent motions at such heights should not entirely neglect the molecular structure of the medium. (auth)

6526

MAGNETOHYDRODYNAMICS OF THE SMALL-SCALE STRUCTURE OF THE F REGION. J. P. Dougherty (Cavendish Lab., Cambridge, Eng.). J. Geophys. Research 64, 2215-16(1959) Dec.

The influence of the E region on Martyn's model for the explanation of radio-star scintillations and spread F in the ionosphere is discussed. (auth)

6527

ELECTRODYNAMIC STABILITY OF A VERTICALLY DRIFTING IONOSPHERIC LAYER. J. A. Fejer (Defense Research Telecommunications Establishment, Ottawa). J. Geophys. Research 64, 2217-18(1959) Dec.

The electrodynamic stability of a vertically drifting ionospheric layer is examined under an instability mechanism postulated by Martyn. No evidence of instability is found. (auth)

6528

TRAVELING DISTURBANCES ORIGINATING IN THE OUTER IONOSPHERE. K. Bibl and K. Rawer (Ionosphären-Institut Breisach, Deutsche Bundespost, Ger.). J. Geophys. Research 64, 2232-8(1959) Dec.

Observations obtained by variations of the classical echo-sounding method are interpreted as resulting from perturbation and/or oscillation phenomena occurring in the outer ionosphere. The vertical velocity component of 'traveling disturbances' coming from outside and propagating through the ionosphere is determined as 115 ± 35 m/sec. Oscillation-like phenomena have a large range of quasi-periods, between 0.25 and 12 hr. (auth)

6529

A RELATIONSHIP BETWEEN THE LOWER IONOSPHERE AND THE [OI] 5577 NIGHTGLOW EMISSION. J. W. McCaulley and W. S. Hough (Boulder Labs., National Bureau of Standards, Colo.). J. Geophys. Research 64, 2307-13(1959) Dec.

The results of a study comparing 5577 A airglow intensity with ionosphere characteristics, using observations near Boulder, Colorado, are presented. The analysis suggests that 5577 variations in airglow intensity can be correlated with variations of an ionospheric stratum. This stratum, as observed by low-frequency sweep soundings, is in the 90- to 110-km region. It is concluded that the observations do not uniquely support any one excitation mechanism for the 5577 emission. (auth)

6530

AN AUTOMATIC METEOROLOGICAL DATA COLLECTING SYSTEM. Robert M. Brown (Brookhaven National Lab., Upton, N. Y.). J. Geophys. Research 64, 2369-72(1959) Dec.

The description of an automatic meteorological data collecting system is given. This device is capable of accepting meteorological information in the form of either a rotation or a voltage. It then converts these inputs to digital information and records them on a paper punch. The tape punch is extremely fast, and it is possible to scan the required information every 0.6 seconds. This eliminates the need for developing mean data prior to the coding. (auth)

6531

HELIUM AS A GROUND-WATER TRACER. Ralf C. Carter, W. J. Kaufman, G. T. Orlob, and David K. Todd (Univ. of California, Berkeley). J. Geophys. Research 64, 2433-9(1959) Dec.

Laboratory and field experiments were conducted with helium as a ground-water tracer. Techniques were developed for the addition and extraction of helium from water. A mass spectrometer and a pressure-volume apparatus were used for helium measurements at concentrations in water ranging from 1.5 to 5.5×10^{-4} mg/l. In the field investigation, flow was traced through a confined aquifer for a distance of 188 ft. Both laboratory and field experiments showed that helium traveled at a slightly lower velocity than chloride. The advantages and disadvantages of helium as a ground-water tracer are discussed. (auth)

6532

ATMOSPHERIC DIFFUSION AND NATURAL RADON. J. R. Philip (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia). J. Geophys. Research 64, 2468(1959) Dec.

A correction is made to Wilkening's analysis of the daily variation of eddy diffusivity of radon near the ground. The term $(-\lambda N)$ is added to the steady-state form of the diffusion equation, showing the phenomenon to be transient. In the above term, N (curie cm^{-3}) is the radon content and $\lambda (= 2.1 \times 10^{-6}\ sec^{-1})$ is the decay constant of radon. (C.J.G.)

6533

ANOMALOUS 'COMMON STRONTIUM' IN GRANITE. W. Compston and P. M. Jefferv (Univ. of Western Australia, Nedlands). Nature 184, Suppl. 23, 1792-3(1959) Dec. 5.

Problems involved in age determinations of strontium-bearing granite are discussed. It is pointed out that a clear

distinction must be made in radioactive age and the age of original crystallization of the whole rock. An example cited is an isolated determination by the strontium/rubidium method using the biotite from a granite which yielded the biotite age only, which was by no means the age of emplacement of the granite. (C.H.)

6534

RUBIDIUM–STRONTIUM AGES OF LEWISIAN ROCKS FROM NORTH-WEST SCOTLAND. Bruno J. Giletti (Univ. Museum, Oxford). Nature 184, Suppl. 23, 1793–4(1959) Dec. 5.

The rubidium–strontium method was used in dating feldspars from Lewisian pegmatites collected in northwest Scotland. An isotope dilution technique was used for determining the rubidium and strontium concentrations and the strontium isotopic composition in the purified mineral. (C.H.)

6535

ABROGATION BY INJECTED MOUSE BLOOD OF PROTECTIVE EFFECT OF FOREIGN BONE MARROW IN LETHALLY X-IRRADIATED MICE. L. J. Cole and R. M. Garver (U. S. Naval Radiological Defense Lab., San Francisco). Nature 184, Suppl. 23, 1815–16(1959) Dec. 5.

Results are reported from an investigation of the effects of normal whole blood on the rejection or acceptance of foreign bone marrow transplants in x-irradiated mice. Results provide further evidence for the presence of immunologically reactive cells in peripheral blood. (C.H.)

6536

GEOCHEMISTRY AND MINERALOGY OF THE COLORADO PLATEAU, URANIUM ORES. Robert M. Garrels and Esper S. Larsen, III, comps. U. S. Geol. Survey Profess. Paper No. 320, 1959. 239p. $2.00(GPO).

The studies reported are aimed at testing the oxidation concept of U ores, developing a knowledge of the stability relations of V and U minerals under varying conditions of pH and oxidation-reduction potentials, and defining the nature and equilibrium conditions of the primary (low-valent) ores. The first five parts present topical data of general application to the Colorado Plateau; parts 6 through 15 cover the results of theoretical, experimental, or empirical studies relating to the chemical and physical nature of ores and their oxidation; in parts 16 through 19 are described the geological relationships between oxidized and unoxidized ore in several ore deposits on the Plateau; part 20 concerns the broad geochemical relationships of V and U throughout the world. The final part summarizes conclusions and particularly emphasizes the salient problems requiring further study. (W.L.H.)

HEALTH AND SAFETY INCLUDING DOSIMETRY

6537 AD-202977

Mare Island Naval Shipyard. Industrial Lab., Calif.

DEVELOPMENT OF A PROCEDURE FOR ESTIMATING THE AMOUNT OF RADIOACTIVITY IN BRACKISH WATER. Report No. 6051-57. Paul T. Wagner. Mar. 5, 1958. 19p.

A method for determining the radio-concentration of brackish waters, containing a low-level of radioactivity, was developed. The value for potassium, after taking into account the low concentration of other radioisotopes, agreed with the calculated potassium activity based on the amount of potassium in the water. The radio-concentration of the Mare Island Channel water was found to be 2.6×10^{-7} microcuries per milliliter with a probable error of about 0.2×10^{-7}. The non-potassium activity was estimated to be 0.2×10^{-7} microcuries per milliliter. In counting, the total number of counts was distributed between sample and background so as to give a minimum standard deviation. The expected randomicity of the counts was confirmed by chisquare tests, which also showed that the mean absolute background was essentially constant for the various counting periods. (auth)

6538 AERE-R-3112

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PROPOSALS FOR IMPROVING THE EFFICIENCY OF CERTAIN ROUTINE RADIOACTIVITY MONITORING OPERATIONS BY INTRODUCING A RAPID SORTING PROCESS. R. C. M. Barnes. Oct. 1959. 15p. BIS.

A two-stage counting procedure is recommended for some routine monitoring operations in which many weak radioactive samples are inspected although an accurate quantitative measurement is required on only the more active samples. In the proposed method all samples are first inspected by a rapid sorting test which rejects the weaker samples. The remainder, which may only be a small proportion, are then counted for a longer, fixed time to determine their activity accurately. Routine counting of α-active samples with the Sample Changer Type 1331 is taken as an example. At present all samples are counted for the same time, but it is shown that the introduction of a preliminary sorting operation would produce at least a six-fold increase in the sample-handling rate. The principles of the sequential test used for rapid sorting are summarized, and practical rules are suggested for selecting the operating parameters of the test. (auth)

6539 CNI-25

Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.

MISURA DELIA RADIOATTIVITÀ BETA TOTALE DEL FALL-OUT E SEPARAZIONE CHIMICA DEI PIÙ IMPORTANTI RADIONUCLIDI. (Measurement of Total Beta Radioactivity of Fall-out and Chemical Separation of the Most Important Radionuclides). A. Cigna, A. Malvicini, and L. Vido. Oct. 1959. 28p.

The method of collection and treatment of fall-out samples and the measurement of the total beta and gamma activity of these samples are described. The chemical separation of the most important radionuclides from the biological point of view is also discussed. The total beta activity of fall-out at Ispra from February 1958 to August 1959 is reported. (auth)

6540 CNI-26

Italy. Comitato Nazionale per le Ricerche Nucleari, Rome.

MISURA DEL RAPPORTO Sr^{89}/Sr^{90} NEL FALL-OUT. (Fall-out Measurement of Sr^{89}/Sr^{90} Ratio). G. Dominici, P. Gaglione, and L. Vido. Oct. 1959. 9p.

A very simple procedure was developed for the determination of the Sr^{89}/Sr^{90} ratio. The strontium separation is made by carrier precipitation of the strontium as the carbonate. The initial activity is measured on the carbonate precipitate. From the activity growth, caused by the formation of Y^{90} not in equilibrium with Sr^{90}, the initial concentration of Sr^{90} can be determined, and then the Sr^{89} concentration is determined by the difference. (auth)

6541 CWLSP-3-8

Chemical Warfare Labs., Army Chemical Center, Md.

A PORTABLE REMOTELY OPERATED DEVICE FOR PRODUCING A GAMMA RADIATION FIELD. Ralph E. Rexroad and Murray A. Schmoke. Dec. 1958. 21p.

A portable field device is described for use in lifting a high-intensity gamma radiation source from its shield

without exposing the personnel. The device is remotely operated. (C.H.)

6542 ITR-1421

Bureau of Yards and Docks. Office of the Chief of Civil Engineers, Washington, D. C.

EVALUATION OF BURIED CONDUITS AS PERSONNEL SHELTERS. Preliminary Report. Gifford H. Albright. Nov. 15, 1957. Decl. July 9, 1959. 76p. Project 3.2 [of] OPERATION PLUMBBOB. OTS.

Twelve large-diameter buried conduit sections of various shapes were tested in the 56-to-153-psi overpressure region to make empirical determination of the degree of personnel protection afforded by commercially available steel and concrete conduits at depths of burial of 5, 7.5, and 10 feet below grade. Instrumentation of the test structures consisted of a total of four electronic channels measuring accelerations, twelve scratch gages measuring deflections, and twenty-four self-recording gages measuring peak accelerations and peak internal pressures. Gamma and early-neutron radiation-shielding measurements were made. All buried conduit sections tested provided adequate Class I protection for the conditions under which the conduits were tested. Standard 8-foot concrete sewer pipe withstood 136-psi overpressure without significant damage, standard 10-gage corrugated-steel 8-foot circular conduit sections withstood 136-psi overpressure without significant damage, and standard 10-gage corrugated-steel cattle-pass conduits withstood 153-psi overpressure without significant damage. All conduits provided adequate total protection against the initial gamma and neutron radiation from a 39.0-kt, relatively high-neutron-flux nuclear device. All types of conduit sections tested provided Class I protection (100-psi overpressure and comparable radiation effects); furthermore, six of the twelve sections provided considerably higher protection. Therefore, if conduits of similar type and of approximate dimensions to those tested, 8-foot circular concrete, 8-foot circular corrugated steel, and 7-foot-8-inch high cattle-pass-type corrugated steel, are to be used as portions of personnel shelters for Class I protection against weapons of approximately similar yield to the test device, it is recommended that such sections be utilized in configurations having approximately 5 feet of earth cover. (auth)

6543 NAA-SR-Memo-1952

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SOME PRELIMINARY EXPERIMENTS WITH SODIUM AND TETRALIN FIRES. R. D. Keen. May 31, 1957. 13p. Project 7504-4855. OTS.

Experiments in which new ideas concerning techniques and materials for combating sodium fires and combination fires of sodium and other materials are described. Also, the effects of burning sodium in contact with concrete were investigated. Materials and experimental techniques are described and results are discussed. Photographs and diagrams are included. (J.R.D.)

6544 NAA-SR-Memo-2924

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EXHAUST VENTILATION REQUIREMENTS FOR PROPOSED PRE BLAST CABINET. E. C. Hickey. July 31, 1958. 6p. OTS.

An evaluation of the exhaust ventilation requirements for the proposed PRE blast cabinet is presented. Abrasive blasting for the decontamination of high level radioactive materials will produce considerable radioactive dust which will require adequate exhaust ventilation and air cleaning. Conclusions and recommendations are given. (W.D.M.)

6545 NP-8264

Organization for European Economic Co-Operation, Par

SYSTEM OF MEASUREMENT OF ENVIRONMENTAL RADIOACTIVITY IN THE O.E.E.C. COUNTRIES, 1959.

A system of regular, rapid exchange of measured data on radioactivity is in the best interest for the control of radiation exposure of man; particularly in those countries with common land frontiers, those grouped around the same sea or ocean, and those through which the same river runs. A survey was made of measuring procedures used in the O.E.E.C. countries. Findings are summarized. (C.H.)

6546 ORO-234

Arkansas. Univ., Fayetteville. Coll. of Arts and Scien

RADIOACTIVE FALLOUT. Annual Progress Report. P. K. Kuroda, Lois M. Fry, and H. L. Hodges. Dec. 31, 1959. 56p. Contract AT(40-1)-2529. OTS.

The present study was undertaken with the following objectives in mind: (a) to see if a rise in deposition of radioactive debris occurred during the spring months of 1959, (b) to study the inter-relationships between the isotope ratios (Ba^{140}/Sr^{89}, Ba^{140}/Sr^{90}, and Sr^{89}/Sr^{90}) in rain and various meteorological factors, such as the rates of transfer of these radioactive nuclides from the stratosphere to the troposphere, the general circulation or global movement of air masses, as well as the stratospheric inventories of various radioactive nuclides. It is concluded that the spring peak of 1959 was primarily due to an increase in the rate of material transfer from the stratosphere to the troposphere, caused by the sinking of a very cold air mass which formed above the winter pole during the late winter months. The increase of the Sr^{90} inventory in the northern stratosphere due to the fall 1958 test series was estimated to be 160%. (W.D.M.)

6547 SCTM-406-59(33)

Sandia Corp., Albuquerque, N. Mex.

AN APPROXIMATION OF RADIATION DOSE RESULTING FROM AN ACCIDENTAL RELEASE OF TRITIUM GAS. H. L. Rarrick and G. E. Tucker, Jr. Dec. 18, 1959. 5p. OTS.

A simple method is developed for calculating the approximate radiation dose for personnel exposed to an accidental release of tritium gas. (auth)

6548 UCRL-5636

California. Univ., Livermore. Lawrence Radiation Lab.

MEASUREMENT OF RADIOACTIVE FALLOUT AIR SEDIMENTATION APPARATUS. John F. Lakner. July 1959. 34p. Contract W-7405-eng-48. OTS.

An apparatus involving a fundamental idea of air sedimentation has been adapted to fractionate radiological fallout samples (size range $D\rho^{0.5} = 2$ to $D\rho^{0.5} = 240$) and measure their radioactivity. This paper describes the principle involved, its limitations, and many of the characteristics of the apparatus. A discussion is included on the use of probability paper for size distribution analysis. (auth)

6549 USNRDL-TR-378

Naval Radiological Defense Lab., San Francisco.

MEASUREMENT OF ABSORBED INTEGRAL RADIATION DOSE IN LARGE PHANTOMS USING CHEMICAL DOSIMETRY. J. H. Arndt and L. H. Gevantman. Oct. 27, 1959. 10p.

Use was made of the ferrous sulfate (Fricke) dosimeter to measure the absorbed integral radiation dose in a large phantom. The purpose of the measurement was to simulate a therapeutic irradiation and confirm the magnitude of a value which was calculated from the irradiation parameters of the therapy treatment. The agreement between values is within 15 to 25%. (auth)

6550 WT-719(Del.)
Naval Medical Research Inst., Bethesda, Md.
RESIDUAL IONIZING RADIATION DEPTH DOSE MEASUREMENTS IN UNIT-DENSITY MATERIAL. F. W. Chambers, R. Sharp, and J. W. Duckworth. Feb. 1957. Decl. with deletions Sept. 15, 1959. 36p. Project 2.2b [of] OPERATION UPSHOT-KNOTHOLE. OTS.

Ionizing radiation, under various conditions, was studied in fields of residual contamination resulting from several nuclear detonations with respect to the relative dose at various depths in approximately unit-density material. Measurements were also made of the initial radiation to permit correlation with previous tests, and comparison of the depth dose curves obtained from the initial radiation with the curves obtained from the residual radiation. Several conclusions may be formed from the data. There is a readily absorbed component present in the residual radiation that is not present in the initial radiation. The depth dose curve for the high-energy component in the case of a fall-out area 3.5 miles from ground zero shows a more uniform distribution of dose throughout the phantom than does the depth dose curve obtained from the initial radiation. Therefore, the effects of a given dose of radiation from a residual field could be more serious than those from the initial radiation because of the relative uniformity of the field of radiation which produces a more uniform dose throughout a man's body, and the additional presence of the readily absorbed radiation. The beta-gamma ratio changes with time, position relative to ground zero and distance above the ground, therefore, it would be difficult to predict this ratio. Good instrumentation could provide the necessary information; however, the survey instruments used during the tests did not measure the readily absorbed component. (auth)

6551 WT-333
Army Medical Service Graduate School, Washington, D. C.
RADIOCHEMICAL STUDIES OF LARGE PARTICLES. Roy D. Maxwell. Apr. 1952. Decl. Sept. 19, 1959. Project 2.5a [of] OPERATION JANGLE. 29p. OTS.

A study has been made of fall-out particles from both the surface and the underground shots at Operation JANGLE. Particles were collected upon trays placed downwind five to ten miles from point zero. The size, radioactivity present including decay, and chemical composition of the particles were determined. The method of mechanical separation of the radioactive particles from the non-active material gave a preference for large sizes. However, the findings indicate that particles as large as five hundred microns fall as far as ten miles from the point of detonation. (auth)

6552 WT-335
Bureau of Plant Industry, Soils, and Agricultural Engineering.
ANALYSIS OF TEST SITE AND FALL-OUT MATERIAL. L. T. Alexander, J. M. Blume, and M. E. Jefferson. Mar. 1, 1952. Decl. Sept. 19, 1959. 26p. Project 2.8 [of] OPERATIONAL JANGLE. OTS.

A study was made of the chemical and physical composition of the sites of the surface and underground shots of JANGLE operation prior to test date. Subsequent to the tests, collections of fall-out material were made. Some physical characterizations have been made of these fall-out materials. Measurement of radioactivity indicates that the fall-out within a four mile distance from zero had an activity of about 10 curies per ton. The fall-out at one-half mile north was more than 1,000 tons per square mile while 63 tons fell at four miles northeast. Fall-out at four miles north-east was somewhat more radioactive per ton than at one-half mile north. Gradation of the material was dependent on distance from zero. Preliminary studies of the uptake of radioactivity from fall-out material mixed with different soils indicate a very high uptake of a beta emitting element of approximately 50 days half life. The element is thought to be strontium-89. The amount taken up from a soil low in calcium is of a magnitude that might constitute a hazard to agriculture. (auth)

6553 WT-395
Naval Radiological Defense Lab., San Francisco.
FALL-OUT PARTICLE STUDIES. I. G. Poppoff, P. D. LaRiviere, E. C. Evans, III, C. E. Adams, J. W. Washkuhn, N. R. Wallace, J. V. Zaccor, S. K. Ichiki, N. H. Farlow, R. K. Laurino, R. R. Soule, and E. A. Schuert. Apr. 2, 1952. Decl. Sept. 19, 1959. 145p. Project 2.5a-2 [of] OPERATION JANGLE. OTS.

The chemical and physical properties and the distribution with time and area of the particulate matter dispersed by a surface and an underground atomic bomb detonation were investigated. Aerosol samplers, differential fall-out collectors, and fall-out trays were designed and developed. Sampling was conducted from ground based stations. The median particle sizes of the gross and radioactive materials were 0.2 μ and 1.4 μ, respectively. The radioactive particles were glassy and had the same elemental composition as the source material except for the absence of carbon and boron. The bulk of the activity was found in the size fraction >20 μ. The time distribution studies showed heavy initial concentrations transported by high altitude winds and followed by several secondary waves of material carried by surface winds. Area distributions were found to be determined by the extent of the base surge and wind profile. (auth)

6554 AEC-tr-3954
INCORRECT IDEAS CONCERNING THE POSSIBILITY OF PROTECTING THE EYES AND BODIES OF WORKERS AGAINST GAMMA-RADIATION BY INDIVIDUAL PROTECTIVE MEASURES. S. M. Gorodinskii (Gorodinskiy) and E. A. Fishevskaya. Translated from Med. Radiol. 2, No. 3, 83-4(1957). 4p. JCL or LC.

6555 JPRS-2135-N
MEMORANDUM FOR USSR POPULATION CONCERNING PROTECTION AGAINST ATOMIC WEAPONS. A translation from PAMYATKA Naseleniyu po Zashchite ot Atomnogo Oruzhiya, 1956. 26p. OTS.

Procedures are outlined for the protection of the civilian population in the event of radiological warfare. Data on atomic weapons and their effects are briefly summarized. Instructions on behavior in case of an alarm and decontamination procedures are included. (C.H.)

6556 JPRS-L-1148-N
HYGIENIC PROBLEMS OF MEDICAL RADIOLOGY. F. G. Krotkov. Translated from Med. Radiol. 4, No. 9, 63-5 (1959). 5p. OTS.

Progress is reported in radiological protection of workers in the atomic energy industry in the U.S.S.R. Studies on the amounts and sources of radiations to which the population is exposed are reported.

6557 JPRS-L-1161-N
THE EMPLOYMENT OF PHOTOGRAPHIC FILM FOR THE INDIVIDUAL DOSIMETRIC CONTROL OF BETA-PARTICLE FLUXES. N. S. Nilitin. Translated from Vestnik Rentgenol. i Radiol. 34, No. 4, 59-65(1959). 10p. OTS.

Results are reported from an investigation of the beta

sensitivity of two photographic films. Possible applications as personnel dosimeters are considered. (C.H.)

6558

APPLICATION OF ELECTROFILTERS TO THE STUDY OF RADIOACTIVE AEROSOLS. Rudolf Wagner (Universität, Munich). Atomkernenergie 4, 481-90(1959) Dec. (In German)

Following a description of the electrostatic filters and the measuring methods used, detailed results are given of both the filters themselves and the aerosol. By efficiency determinations former specifications concerning rapidity of separation were confirmed. The experiments showed a selective behavior of the filters concerning size of particles to be unlikely. The efficiency variation at the change-over from one-way to full wave unsmoothed rectified high voltage with the filter obeys a relationship resulting from the theoretical efficiency formula, which is confirmed indirectly. The filter efficiency is decreased slightly if a layer of dust is formed on the collecting electrode during exposure; as a cause the rebreak-off of particles from the surface of the dust layer is to be supposed. The activity concentration of radioactive fission products in the atmosphere was recorded in 1957/58 during 11 months and the half-life period of the mixture of fission products at the day of exposure was determined. The monthly average values of these half-life periods, the frequency distribution, and the monthly average values of dust concentration and specific activity of the dust are given. From the half-life period of the aerosol the age of the aerosol can be resulted. The formation of average values involved an interesting relationship between activity concentration and age of aerosol. This relationship is discussed. (auth)

6559

MEASUREMENTS OF THE RADIOACTIVITY IN AIR, PRECIPITATION, AND SURFACE WATERS DURING CATASTROPHIC HIGH WATER IN THE NORTHERN ALPS. Reinhold Reiter (Universität, Munich and Physikalisch-Bioklimatische Forschungsstelle, Munich). Atomkernenergie 4, 490-2(1959) Dec. (In German)

The results of measurements of the radioactivity in air, precipitation, surface water (brooks etc.), spring water, and tap drinking water before, during, and after a catastrophic high-water in the Northern Alps are presented and discussed. During the continuous heavy precipitation, the artificial radioactivity of the air decreased to nearly zero, since it was washed out. The natural air radioactivity values, on the other hand, were extremely high in spite of the washing out effect of the simultaneous precipitation, because radon and thoron were expelled from the depots in the soil by the rising subsoil water. About 7% of the specific radioactivity of the precipitation was found, in those abnormal circumstances, in springs coming directly out of the rock and in river water. The high-water conditions caused perceivable amounts of fission products to penetrate also into the tap drinking water of a place of about 30,000 inhabitants, but the "maximum concentration of beta-emitting fission products of unknown composition allowable for long continued consumption" was not reached. The specific radioactivity of this tap drinking water was found to be only about 1% of that in the heavy precipitation which had caused the high-water. Several weeks after the high water, the contamination of the springs used for the drinking water supply having considerably decreased, there were still perceivable traces of fission products in the tap drinking water. It was shown by these measurements that not even under catastrophic high-water conditions any threat is presented to man by fission products in tap drinking water, if the artificial radioactivity in precipitation is of the same order of magnitude as is its average in the Northern Alps at present. Control measurements, however, carried out also some time after a high-water, will be useful. (auth)

6560

CONCENTRATION OF AN EMANATION IN THE AIR. J.-C. Philippot and A. Becker. Bull. inform. sci. et tech. (Paris) No. 33, 12-23(1959) Oct. (In French)

The connection between the apparent activity measured with a given detecting system and the actual concentration of the natural and artificial radioactive products in the air is investigated. The following points were studied: the equilibrium between the radioactive products, which is established on the filter-paper during the sampling; the decay chain of the various emitters and the sensitiveness of the detector to the different radiations; the influence of warping of the filter-paper and the absorption which is produced in front of these radiations; the determination of the geometrical factor of the detector. This study was made for the case of three different experimental devices. The agreement between these three cases and the theoretically predicted results is quite satisfactory. (auth)

6561

HYGIENE ASSESSMENT OF LABOR CONDITIONS OF WORKERS HAVING CONTACT WITH CERTAIN RADIOACTIVE MINERALS. O. S. Andreeva. Med. Radiol. 4, No. 12, 59-63(1959) Dec. (In Russian)

Hazards arising from the handling of radioactive minerals are enumerated. Sanitation measures are recommended. Measures for radioactive contamination control with respect to equipment, protective garments, and the worker's body are discussed. (C.J.G.)

6562

FRACTIONATION PHENOMENA IN NUCLEAR WEAPON DEBRIS. K. Edvarson, Kerstin Löw, and J. Sisefsky (Research Inst. of National Defence, Stockholm). Nature 184, 1771-4(1959) Dec. 5.

It was previously determined that a chemical fractionation of nuclear weapon debris takes place during the particle formation which occurs within the first few minutes after the explosion. Results are reported from studies of the distribution of different fission products in air-borne bomb debris and an attempt is made to interpret the results. (C.H.)

6563

CONCENTRATION OF CESIUM-137 IN THE COASTAL WATERS OF JAPAN (1959). Noboru Yamagata (Inst. of Public Health, Tokyo). Nature 184, Suppl. 23, 1813-14(19[illegible] Dec. 5.

The concentration of cesium-137 in samples of coastal waters of Japan collected in 1959 was determined. Methods are described and data are tabulated. (C.H.)

6564

IN-VIVO DOSIMETRY WITH MINIATURE GLASS RODS. Stanley J. Malsky, Bernard Roswit, Charles Amato, Cyprian B. Reid, Sol M. Unger, and Charles Spreckels (Veterans Administration Hospital, Bronx, N. Y.). Radiology 74, 107(1960) Jan.

A glass rod microdosimeter is described which utilizes the concept of radiophotoluminescence of glass rods for human in vivo measurements during radiation therapy. (C.H.)

6565

TOTAL BODY SCANNER FOR HIGH ENERGY GAMMA RAYS. J. S. Laughlin, J. W. Beattie, K. Corey, A. Isaac-

son, and P. Kenny (Sloan-Kettering Inst. for Cancer Research, New York). Radiology 74, 108(1960) Jan.

The design and performance are described for a scintiscanner for use with isotopes with high-energy gamma rays such as calcium-47 and zinc-65. Applications in metabolic studies in man are discussed. (C.H.)

6566

ON MEASURING EXPOSURE DOSE IN PHANTOMS WITH THIMBLE CHAMBERS. Gail D. Adams (Univ. of California Medical Center, San Francisco). Radiology 74, 108-9(1960) Jan.

Applications of the Victoreen condenser rate meter for obtaining absorbed-dose information in tissue or phantoms is discussed. Correction factors for conversion of exposure dose to absorbed dose are given. (C.H.)

6567

CELL DOSIMETRY. Arnold Feldman and Dimitry Morkovin (Univ. of Colorado, Denver). Radiology 74, 112-13(1960) Jan.

Applications of in vitro single cell cultures for the dosimetry of ionizing radiations are discussed. An example is presented of the application of the cell dosimeter in determining absorbed dose in a transition zone where electron equilibrium does not obtain. (C.H.)

6568

PRELIMINARY SURVEY OF RADIUM 226 AND RADIUM 228(MsThI) CONTENTS OF DRINKING WATER. Henry F. Lucas and Douglas P. Krause (Argonne National Lab., Lemont, Ill.). Radiology 74, 114(1960) Jan.

Preliminary data are presented from a survey of the natural radium-226 content of municipal drinking waters in the Middle West. Measurements were also made of the radium-228 concentrations in a number of the water samples. (C.H.)

6569

EXPERIMENTS ON ISODOSE MEASUREMENTS WITH A CHEMICAL DOSIMETER. Wolfgang Schubert (Universität, Erlangen, Ger.). Strahlentherapie 110, 548-58(1959) Dec. (In German)

The known chemical dosimeter systems such as the Fe-II- and the Ce-IV-system and the halogenated carbonhydrates are not satisfactory for a semisolid radiosensitive phantom material. Organic dyes in watery solution are not sensitive enough for medical dosimetry. A gel containing potassium iodide and starch, which was stabilized with benzoic acid, was a suitable system. Its sensitivity is sufficient to determine doses between 25 and 3000 r. Numerous experiments were made with agar agar, which proved to be a suitable gel material. The new chemical dosimeter was tested for its sensibility, sensibilization ability, dependence of the sensitivity to the energy, and effect of storage time to change of the colour. The practical use for isodose determination is rendered difficult, because there is no tissue equivalent absorption. It requires a laborious correction method. For qualitative demonstrations of the course of radiation in the phantom the KJ-gel is very suitable. (auth)

6570

THE PROBLEM OF DIRECT DOSE DETERMINATION IN THE INTESTINE DURING INTRAUTERINE AND VAGINAL APPLICATION AND ITS SOLUTION. Andreas Siegert (Städt. Marienkrankenhauses, Amberg, Ger.). Strahlentherapie 110, 590-94(1959) Dec. (In German)

A method of direct dose determination in the intestine during intrauterine and vaginal application of radioactive substances at different locations of the endangered intestine was described. The method is independent of the change of the position between radioactive substance and intestine. The most important properties of the ionization chambers were described and the practical use of the method was discussed and demonstrated by an example. The results of this type of dose determination are satisfactory and much more accurate than the results obtained by momentary dose determination. (auth)

6571

X-RAY DOSIMETRY WITH PLASTICS. Kurt Heuss (Max-Planck-Institut für Biophysik, Frankfurt am Main). Strahlentherapie 110, 628-30(1959) Dec. (In German)

A method of dose determination of x rays was described making photometric use of the change of color of plastics. The method can be applied up to a dose about 5×10^5 r. Higher doses change the internal structure of the plastic. Some examples for its use were given. (auth)

ISOTOPE SEPARTION

6572 A-50

Columbia Univ., New York.

THEORY OF THE SIMPLE-PROCESS FLOW-THROUGH CENTRIFUGE. Karl Cohen. [194?]. Decl. Feb. 1, 1960. 44p. OTS.

The common principles underlying the theories of all types of isotope separation apparatus are discussed, and illustrated by existing theories of thermal diffusion columns and counter-current centrifuges. The method outlined is applied to the flow-through centrifuge, and a rigorous theory for this instrument is developed. An approximate theory is also found, compared with the exact theory, and corrected. It is then compared with experiment and found to be adequate. Working with the corrected approximate theory, the optimum operating conditions for a flow-through centrifuge, considered as one of a net-work of identical instruments, are determined. Three principal improvements in the design or use of flow-through centrifuges are shown to be the construction of a central core of a particular size, the operation of the centrifuge at a certain percent of its full equilibrium separation, and the use of larger-diameter rotors. (auth)

6573 MLM-1088

Mound Lab., Miamisburg, Ohio.

THERMAL DIFFUSION: A BIBLIOGRAPHY. G. R. Grove. June 30, 1959. 60p. Contract AT-33-1-GEN-53. OTS.

A comprehensive compilation of references from the technical literature on thermal diffusion is presented. Most of the references are from journals covered by Chemical Abstracts, Physics Abstracts, or Science Abstracts. The authors, titles, and standard references of over 900 publications from 1856 through 1957 are listed. The journal articles were selected for their direct applicability to gaseous or liquid thermal diffusion or because they contained very closely associated discussions. Also, the references to a number of books and graduate theses are included. It is believed that the journal articles listed represent the most nearly complete and accurate bibliography on thermal diffusion available in a single source. Reprints, photocopies, or the journals themselves were examined in nearly every case to insure pertinency and accuracy of the references. (auth)

6574 NYO-7763

Columbia Univ., New York.

SEPARATION OF ISOTOPES. Annual Progress Report. T. I. Taylor. Oct. 1, 1959. 179p. Contract AT(30-1)-755. (CU-12-59-AT(30-1)-755-Chem.). OTS.

Experimental work related to the concentration of N^{15} and O^{18} by chemical exchange methods is described. The experiments were primarily concerned with a study of reflux systems and the determination of the optimum operating conditions, such as temperature, concentration, and flux rates, in the exchange columns. The determination of single stage enrichment factors by direct measurement on equilibrated systems and by operation of exchange columns is described. (W.D.M.)

6575 NYO-7763(Pt. II)
Columbia Univ., New York.
ENRICHMENT OF NITROGEN-15 BY CHEMICAL EXCHANGE OF NO WITH LIQUID N_2O_3. E. U. Monse, W. Spindel, Lois Nash Kauder, and T. I. Taylor. 47p.

At low temperatures, a two phase exchange system results which may be represented as: $N_2^{14}O_3(liq.) + N^{15}O(gas) \rightleftharpoons N^{14}N^{15}O_3(liq.) + N^{14}O(gas)$. Preliminary results on the use of this exchange reaction were previously reported. The results of an investigation on the characteristics of this exchange system and a study of those factors that are important in evaluating its use in concentrating N^{15} are reported. (W.D.M.)

6576 NYO-7763(Pt. III)
Columbia Univ., New York.
ENRICHMENT OF OXYGEN-18 BY CHEMICAL EXCHANGE OF NITRIC OXIDE WITH NITRIC ACID SOLUTIONS. S. C. Saxena and T. I. Taylor. 57p.

Recently 99.9% N^{15} was prepared by the chemical exchange of nitric oxide and nitric acid, and since this exchange must involve water, O^{18} exchange between NO and H_2O should also occur. Preliminary measurements for the enrichment of O^{18} according to this exchange appeared promising. The design of a laboratory scale system and a study of the effect of operating conditions are described in detail. (W.D.M.)

6577 NYO-7763(Pt. IV)
Columbia Univ., New York.
EXCHANGE OF OXYGEN-18 BETWEEN WATER AND ALUMINOSILICATE (MOLECULAR SIEVE) ADSORBENTS USING CARBON DIOXIDE AS A MONITOR. S. C. Saxena and T. I. Taylor. 25p.

The reflux system for the concentration of O^{18} by chemical exchange of NO with HNO_3 solutions, requires the rather complete removal of water from an exit gas stream and the return of this water to the exchange column. Previous work has shown that O^{18} of water exchanges with metal oxides, oxide catalysts, activated clays, etc., at elevated temperatures. Experiments are described in which the extent of oxygen exchange between water and aluminosilicate (molecular sieve) adsorbents was determined. (W.D.M.)

6578 NYO-7763(Pt. V)
Columbia Univ., New York.
REFLUX SYSTEM FOR THE NO–$H_2O(HNO_3)$ EXCHANGE. EXPERIMENTS ON THE DECOMPOSITION OF NITRIC OXIDE BY CATALYSIS AND ELECTRIC DISCHARGE. J. Shupack and T. I. Taylor. 13p.

The equilibration of NO with HNO_3 solutions results in the concentration of O^{18} in the gas phase. Multiplication of the single stage effect in an exchange column requires the complete conversion of NO to 4 to 10 M HNO_3 without the addition of O from other sources. This was accomplished by decomposition of a part of the NO followed by reaction of the resulting gases with H_2O. Methods are considered for controlling the extent of decomposition of NO so that the concentration of NO_2 in the resulting gases is that needed to form the desired concentration of HNO_3. (W.D.M.)

6579 NYO-7763(Pt. VI)
Columbia Univ., New York.
MEASUREMENT OF ISOTOPIC EXCHANGE EQUILIBRIA. A. EXCHANGE OF OXYGEN-18 BETWEEN NO AND $H_2O(HNO_3)$. J. Shupack, S. C. Saxena, and T. I. Taylor. 6p.

Exchange of O^{18} between NO and $H_2O(HNO_3)$, exchange of O^{18} and N^{15} between NO_2 and N_2O_4, catalysis of the exchange of O^{18} between CO_2 and H_2O are discussed. (W.D.M.)

6580 NYO-7763(Pt. VIII)
Columbia Univ., New York.
AN ELECTRICAL DISCHARGE METHOD OF PREPARING SAMPLES FOR MASS SPECTROMETRIC ANALYSES OF 15 AND O-18. T. I. Taylor. 10p.

The separation of N^{15} and of O^{18} by the exchange of NO with NO_2, HNO_3, or N_2O_3 requires the determination of these isotopes in gaseous oxides of nitrogen and in solutions of nitric acid. Mass spectrometric analysis for N^{15} done most reliably with the N in the form of N_2 molecules. The usual method for the determination of O^{18} involves conversion of the O of the sample to CO_2, CO, O_2, or H_2O. An electrical discharge method of preparing samples for analysis and determination of O^{18} and N^{15} in water and nitric acid are discussed. (W.D.M.)

6581
ELECTROMIGRATION OF RADIOACTIVE IONS IN FUSED SALTS. APPLICATION TO THE SEPARATION OF ISOTOPES. Harirao Jeevan Arniker (Université, Paris). Ann. phys. (13) 4, 1291-1339(1959) Nov.-Dec. (In French)

The use of asbestos paper to support a liquid phase for chromatography and electrophoresis of fused salts is described. Ionic mobility studies using radioactive tracer studies are possible by this technique. Several ionic mobility studies are described. The technique was also applied to $Na^{24}-Na^{22}$, Li^6-Li^7, $K^{39}-K^{41}$, $Rb^{85}-Rb^{87}$, and $Cs^{137}-Cs^{131}$ separations. (T.R.H.)

6582
THE ENRICHMENT OF LITHIUM ISOTOPES BY ION-EXCHANGE CHROMATOGRAPHY. II. THE INFLUENCE OF TEMPERATURE ON THE SEPARATION FACTOR. D. A. Lee (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 187-8(1960) Jan.

The effect of temperature on the equilibrium constant in ion exchange reactions of lithium ions at 3 to 59°C was studied. From a plot of log α vs. 1/T, the heat of exchange was calculated to be 2.26 cal/mole and $-\Delta S$ was determined to be 1.81×10^{-3} cal/mole degree at 25°C. (C.J.G.)

6583
THE ISOTOPIC EFFECT OF LITHIUM IONS IN COUNTERCURRENT ELECTROMIGRATION IN MOLTEN LITHIUM BROMIDE AND IODIDE. Arnold Lundén, Stina Christofferson, and Alex Lodding. Trans. Chalmers Univ. Technol. Gothenburg No. 221, 38p. (1959). (In English)

The isotopic effect of electromigration was studied for lithium ions in the following chains of molten salts: cathode + Br_2/LiBr/$PbBr_2$/Br_2 anode; cathode Pb/$PbBr_2$‖ LiBr/$PbBr_2$/Br_2 anode; and cathode Pb/PbI_2‖ LiI/ PbI_2/I_2 anode (‖ indicates a diffuse boundary). The heavy isotope Li^7 was enriched in a separation column at the boundary between the lithium and lead halides. The maximal enrichment obtained corresponded to a separation factor of 970. The mass effect (relative difference in mobility for ions of the two isotopes, divided by their relative difference in mass) for Li was found to be -0.148 ± 0.014 in LiBr and -0.15 ± 0.02 in LiI. The results are in agreement with what can be expected from Klemm's theory for the isotopic effect. (auth)

6584

METHOD OF SEALING A PIECE IN ONE END OF A TUBE MADE OF A SINTERED MATERIAL. (to Commissariat a l'Atomique). British Patent 825,395. Dec. 16, 1959.

A method of sealing a metallic plug or tubular connector in a tube of sintered material is described. The plug or connector is placed inside the sintered tube (i.e., Ni powder sintered at 700°C). The plug outside diam. is 14 mm and the tube inside diam. is 15 mm at room temperature. Tube thickness is 0.2 mm. The portion to be sealed is put in the windings of an induction heater and heated in vacuum to 1100°C to seal the tube. (T.R.H.)

6585

PROCESS FOR THE SEPARATION OF GASEOUS OR VAPOROUS SUBSTANCES, MORE ESPECIALLY ISOTOPES. Erwin Willy Albert Becker. British Patent 825,798. Dec. 23, 1959.

An improvement of the expanding jet isotope separation process of patent No. 794,834 is offered. It was found that pressure ratios before nozzle/after diaphragm and before nozzle/after nozzle can be reduced to $\frac{1}{2}$ or $\frac{1}{3}$ to increase separation if a light gas (H_2 or He) is added. (T.R.H.)

6586

IMPROVEMENTS IN OR RELATING TO THE SEPARATION OF THE ISOTOPES OF HYDROGEN. Eugen Glueckauf and Gilbert Pollock Kitt (to United Kingdom Atomic Energy Authority). British Patent 825,934. Dec. 23, 1959.

Separation of H isotopes by gas chromatography is described. A 60-cm glass tube of 0.6 cm diam. was filled with a mixture of Pd powder and asbestos in the ratio 10 to 3 and fitted in a steam jacket. After evacuation at 100°C and cooling, a mixture of H_2, D_2, and HD was passed in at 25 cc/min followed by pure H_2. Pure D_2 was drawn off at the top followed by pure H_2 with only a short overlap zone. (T.R.H.)

6587

IMPROVEMENTS IN OR RELATING TO THE SEPARATION OF ISOTOPES. Derek Raymond Augood and Thomas Albert Hall (to United Kingdom Atomic Energy Authority). British Patent 826,128. Dec. 31, 1959.

Deuterium and normal hydrogen are separated by their differential solubilities in liquefied gases. Continuous or batch operation is possible. In one method the hydrogen–deuterium mixture flows countercurrent to the solvent at 50 to 200 atm. The solvent is then allowed to expand and release D-rich gas and then be compressed and recycled. (T.R.H.)

6588

CALUTRON RECEIVER. S. W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,901,617. Aug. 25, 1959.

An improvement in a calutron receiver for collecting the isotopes is described. The electromagnetic separation of the isotopes produces a mass spectrum of closely adjacent beams of ions at the foci regions, and a dividing wall between the two pockets is arranged at an angle. Substantially all of the ions of the less abundant isotope enter one of the pockets and strike one side of the wall directly, while substantially none of the ions entering the other pocket strikes the wall directly.

6589

CALUTRON ION SOURCE SLIT CLEANER. A. M. Starr (to U. S. Atomic Energy Commission). U. S. Patent 2,901,619. Aug. 25, 1959.

An apparatus is described for removing deposits from the beam forming slits of the source without affecting the vacuum. A scraper element having a configuration conforming to the cross section of the slit is positioned therein, and linkage is provided for moving the scraper along the slit and for retracting the scraper to one end during normal operation.

6590

ISOTOPE SEPARATING APPARATUS CONTROL. S. W. Barnes (to U. S. Atomic Energy Commission). U. S. Patent 2,901,620. Aug. 25, 1959.

An improved isotope separating apparatus of the electromagnetic type, commonly referred to as a calutron, is described. Improvements in detecting and maintaining optimum position and focus of the ion beam are given. The calutron collector is provided with an additional electrode insulated from and positioned between the collecting pockets. The ion beams are properly positioned and focused until the deionizing current which flows from ground to this additional electrode is a minimum.

6591

CALUTRON FACE PLATE. W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,901,621. Aug. 25, 1959.

The construction of a removable cover plate for a calutron tank is described. The plate is fabricated of a rectangular frame member to which is welded a bowed or dished plate of thin steel, reinforced with transverse stiffening ribs. When the tank is placed between the poles of a magnet, the plate may be pivoted away from the tank and magnet and is adapted to support the ion separation mechanism secured to its inner side as well as the vacuum load within the tank.

6592

CALUTRON CONTROL DEVICE. L. W. Baldwin (to U. S. Atomic Energy Commission). U. S. Patent 2,901,622. Aug. 25, 1959.

Several interlock and control circuits for a calutron are described. In one of the arrangements, the ion source cooling water flow is interlocked with the current supply to the heaters associated with the charge chamber, arc chamber, and electrode structure. When the ion source coolant flow rate exceeds a predetermined level, the heater associated with the charge chamber is energized. After the charge chamber has reached a predetermined temperature, the arc chamber heater is energized. Thereafter, the electrode structure heater is energized and the ion source is ready to have the operating voltages applied.

6593

VAPOR VALVE. L. F. Wouters (to U. S. Atomic Energy Commission). U. S. Patent 2,901,623. Aug. 25, 1959.

Electromagnetically operated vapor valves are described for apparatus employed in the separation of isotopes or elements to control the flow of gaseous vapors between a vaporizing charge chamber and an ionizing chamber. The charge chamber and ionizing chamber are positioned in a magnetic field, and the flow of vapors through an orifice connecting the chambers is regulated by regulating the flow of current through a resilient metal strip rigidly mounted at one end and positioned in the magnetic field adjacent to the orifice.

6594

CALUTRON RECEIVER STRUCTURE. J. L. Roush (to U. S. Atomic Energy Commission). U. S. Patent 2,903,587. Sept. 8, 1959.

A receiver is described for collecting isotopes in a

calutron. The receiver has several compartments, formed by a series of parallel metal plates and an open front. Each plate has flanges which space it from the other plates and a flexible extension pressing against a common supporting rod to maintain the plate in assembled relation when all but the last rod is removed. The plates may be removed individually from the front of the receiver, cleaned, and replaced without disturbing the alignment of the other plates.

6595

METHOD OF AND APPARATUS FOR WITHDRAWING LIGHT ISOTOPE PRODUCT FROM A LIQUID THERMAL DIFFUSION PLANT. M. Dole (to U. S. Atomic Energy Commission). U. S. Patent 2,905,527. Sept. 22, 1959.

An improved process and apparatus are described for removing enriched product from the columns of a thermal diffusion plant for separation of isotopes. In the removal cycle, light product at the top of the diffusion columns is circulated through the column tops and a shipping cylinder connected thereto until the concentration of enriched product in the cylinder reaches the desired point. During the removal, circulation through the bottoms is blocked by freezing. In the diffusion cycle, the bottom portion is unfrozen, fresh feed is distributed to the bottoms of the columns, and heavy product is withdrawn from the bottoms, while the tops of the columns are blocked by freezing.

6596

CALUTRON RECEIVER. W. O. Brunk (to U. S. Atomic Energy Commission). U. S. Patent 2,906,876. Sept. 29, 1959.

A description is given for an improved calutron receiver having a face plate lying at an angle to the direction of the entering ion beams but having an opening, the plane of which is substantially perpendicular to that of the entering ion beams. By so positioning the opening in the receiver, the effective area through which the desired material may enter the receiver is increased, and at the same time the effective area through which contaminating material may enter the receiver is reduced.

6597

CALUTRON. F. F. Oppenheimer (to U. S. Atomic Energy Commission). U. S. Patent 2,906,877. Sept. 29, 1959.

An ion source adapted for rapid replacement of a defective cathode is described. The cathode of the ion source, located within the calutron vessel, is releasably clamped to a support. A tool mechanism extends through a wall of the vessel and is operable to release the clamping means. After the clamping means are released, the cathode is withdrawn into a vacuum lock chamber by a second externally manipulated tool, to permit replacement of the cathode without breaking the vacuum in the vessel.

MATHEMATICS AND COMPUTERS

6598 GAT-DM-788

Goodyear Atomic Corp., Portsmouth, Ohio.

IBM PROGRAM FOR FITTING DATA TO SIMPLE EXPONENTIAL CURVES OF THE FORM $y = ab^x$. T. B. Patterson. Nov. 16, 1959. 4p. OTS.

An IBM Program which will fit data to the equation $y = ab^x$ was written. The program is designed to fit up to four-hundred points with relatively little preparation by the user. The program has been checked out and is identified as Deck Number 689. (J.R.D.)

6599 HW-SA-1706

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STATISTICAL INTERROGATION OF DATA FOR ALTERNATIVE MODELS. R. L. Basmann and L. G. Waters. May 25, 1959. 79p. OTS.

A program of statistical interrogation of operating data as a form of investigation to be employed sometimes preliminary to the design and execution of experiments or simulation models, and sometimes as an independent research tool in itself, is described. (W.L.H.)

6600 NP-8233

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

ALGEBRAS OF FINITE DIFFERENTIAL ORDER AND THE OPERATIONAL CALCULUS. Leopoldo Nachbin. 1959. 40p. (Notas de Física Vol. V, No. 10).

The present work arose from a desire to extend part of the known results of the theory of differentiable manifolds due to Whitney, to a larger class of spaces which are not required to be locally Euclidean a priori. Consideration is given to the proof of the assertion that, if C is a category of pure separated algebras whose radicals are nilpotent and $n \geq 0$ is an integer, in order that every topological algebra which is locally convex with respect to C should have a pre-operational calculus with n-differentiable functions, it is necessary and sufficient that C be a subcategory of the category D_{n+1} of all pure separated algebras of differential order $n + 1$. (W.D.M.)

6601 SCR-121

Sandia Corp., Albuquerque, N. Mex.

GRAPHS OF THE HYPERGEOMETRIC O.C. AND A.O.Q. FUNCTIONS FOR LOT SIZES 10 TO 225. C. R. Clark and L. H. Koopmans. Sept. 1959. 172p. OTS.

Graphs of the hypergeometric operating characteristic (O.C.) and average outgoing quality (A.O.Q.) functions are given for lot sizes 10 to 225 and various sample sizes. Graphs for acceptance numbers 0(1)2 and 0(1)3 are included. (auth)

6602 SCR-139

New Mexico. Univ., Albuquerque.

ON OPERATOR SOLUTIONS OF BOUNDARY-VALUE PROBLEMS. Oswald Wyler. Dec. 1959. 30p. For Sandia Corp. Contract 51-6543. OTS.

A discussion of properties of operator solutions, of relations between operator solutions, and of the class of all operator solutions is given. Solutions of inhomogeneous boundary-value problems by Green operators are discussed. The connections between operator solutions of scalar and vector problems are studied. (C.J.G.)

6603

ON THE IDENTIFIABILITY PROBLEM FOR FUNCTIONS OF FINITE MARKOV CHAINS. Edgar J. Gilbert (Sandia Corp., Albuquerque, N. Mex.). Ann. Math. Statist. 30, 688-97 (1959).

Extensions of the methods of Blackwell and Koopmans are utilized in solving the identifiability problem for functions of finite Markov chains. It is shown that there are $\Sigma\{n(\epsilon)\}^2 - N$ "unidentifiable" parameters in the matrix X (a nonsingular $N \times N$ matrix) and at most $N^2 - \Sigma\{n(\epsilon)\}^2$ "identifiable" parameters, determined by the distribution of $\{Y_n\}$ (stationary sequence of random variables with D states as a function of a finite Markov chain), in the matrix A ($N \times N$ matrix). (C.J.G.)

6604

ON THE SPECTRUM OF SCHROEDINGER'S AND DIRAC'S OPERATORS. M. Sh. Birman (Zhdanov Leningrad State

Univ.). Doklady Akad. Nauk S.S.S.R. 129, 239-41(1959) Nov. 11. (In Russian)

Simple analysis of quadratic configuration perturbation theory tends to explain the spectral character of certain semilimited singular boundary problems. Results are presented of further analyses as applied to the Schroedinger operator. A similar analysis can be applied in investigations of certain non-semilimited operators. The method is adapted to the analysis of Dirac operators. (R.V.J.)

METALS, CERAMICS, AND MATERIALS

General and Miscellaneous

6605 BM-RI-5549
Bureau of Mines.
METALLURGICAL LABORATORY DATA ON REDUCTION AND REFINING OF CERIC OXIDE AND CEROUS FLUORIDE TO CERIUM INGOT. E. Morrice, J. Darrah, E. Brown, C. Wyche, W. Headrick, R. Williams, and R. G. Knickerbocker. Jan. 1959. 39p.

An improved electrowinning process is presented for producing high-purity cerium ingot. (W.L.H.)

6606 BMI-258
Battelle Memorial Inst., Columbus, Ohio.
IDENTIFICATION OF SLAG CONSTITUENTS FROM URANIUM METAL PRODUCTION BOMBS. D. A. Vaughan, G. G. Cocks, and C. M. Schwartz. Jan. 31, 1952. Decl. Dec. 15, 1959. 20p. Contract AT-30-1-Gen-228. OTS.

X-ray and microscopic examination of slags from U metal production bombs indicate that UO_2 results from reaction of the UF_4 with liner material and water. (auth)

6607 BMI-X-126
Battelle Memorial Inst., Columbus, Ohio.
MINUTES OF CONFERENCE ON HYDROGEN IN URANIUM, HELD AT BATTELLE MEMORIAL INSTITUTE, JUNE 11, 1954. Clyde R. Tipton, Jr. July 2, 1954. Decl. Dec. 15, 1959. 23p. OTS.

Information from contributors at a conference on hydrogen in uranium is presented. Discussions on the analysis of uranium for hydrogen are included as well as dehydrogenation treatments, hydrogen pickup in uranium processing, effects of hydrogen on corrosion, and physical properties of uranium. Tables showing the solubilities of hydrogen in uranium are also included. (J.R.D.)

6608 CF-60-1-2
Oak Ridge National Lab., Tenn.
TEMPERATURE STRUCTURE IN THE MIDPLANE SPACER FOR EGCR FUEL ROD. L. G. Epel and J. K. T. Jung. Jan. 4, 1960. 8p. OTS.

The steady-state temperature structure for a cross sectional area at the midplane of the EGCR fuel rod is presented. The temperatures are given for the UO_2 as well as for the stainless steel tubing and spacer. (auth)

6609 CRMet-849
Atomic Energy of Canada Ltd., Chalk River, Ont.
HYDROGEN PICK-UP IN ZIRCONIUM ALLOYS, A REVIEW OF DATA UP TO JUNE 1, 1959. G. J. Biefer, L. M. Howe, A. Sawatsky, and F. H. Krenz. Sept. 1959. 69p. (AECL-919). AECL.

The fundamental properties of the Zr–H system are discussed and the distributions of the hydride phase in α-Zr are shown. The thermal diffusion and concentration diffusion of H in Zircaloy-2 are discussed, and a set of curves is given which permits estimation of the hydrogen enrichment that may result from a thermal gradient. The damage to a surface oxide by hydriding and the effect of the oxide film on the absorption of H by Zr during furnace charging are considered. Experimental data on the pick-up of hydrogen by Zircaloy-2 and other Zr alloys, published prior to May 1959, are reviewed relative to the effects of radiation, water composition, and the alloying elements. Data on the effect of ZrH_2 on the mechanical properties of Zr and Zr alloys are reviewed. The pick-up of H in fuel sheaths and by Zircaloy-2 pressure tubes is predicted. The applicability of Zircaloy-2 to present reactor designs is evaluated. Curves are presented to show expected rates of hydriding. (C.J.G.)

6610 DMIC-119
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
HEAT TREATMENT OF HIGH-STRENGTH STEEL FOR AIRFRAME APPLICATIONS. R. J. Fiorentino, D. R. Roach, and A. M. Hall. Nov. 27, 1959. 106p. Contract AF18(600)-1375. (PB-151076). OTS.

A summary of the information gathered from four steel producers and twenty-four steel consumers on the status of the heat treatment of high-strength steels for airframe applications is presented. The materials covered in the report are low-alloy hardenable engineering steels, hot-work die steels, martensitic stainless steels, martensitic precipitation-hardenable stainless steels, semiaustenitic precipitation-hardenable stainless steels, austenitic precipitation-hardenable stainless steels, and cold-rolled austenitic stainless steels. The topics covered under each material include illustrative heat treatments, uses, fabrication, atmospheres, protective coatings, cleaning, and descaling. Also included is a list of some large-capacity heat-treating-furnace equipment available throughout the country. (auth)

6611 NAA-SR-4204
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
TESTS OF A MECHANICAL PIPE JOINT FOR SODIUM SERVICE. C. Sutherland. Jan. 15, 1960. 26p. Contract AT-11-1-GEN-8. OTS.

A test program was conducted to determine the suitability of a mechanical pipe joint for use in liquid sodium systems. Tests were performed on a total of five units representing three pipe sizes—2-, 6-, and 12-in. The joints were subjected to flexural, axial, tensile, and compressive mechanical loads while containing sodium at a maximum temperature and pressure of 1000°F and 150 psig. Of the three sizes tested, only the 2-in. size performed satisfactorily. The other units leaked sodium during the mechanical load tests after having sealed 1000°F sodium under no-load conditions. It is concluded that the 2-in. units have a good probability of performing satisfactorily in elevated temperature sodium service with nominal adjacent pipe wall stresses up to a maximum of 14,000 psi. It is further concluded that the larger sizes tested will probably provide good high-temperature sodium seals, but their use must be restricted to service at very low stress levels. Tolerance limits were not established for flange warpage due to welding. It was found that the mechanical pipe joints tested will not seal under the test conditions if they become out-of-round as much as 10 mils. (auth)

6612 NAA-SR-4233
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

INTERIM REPORT ON THE ALUMINUM POWDER METALLURGY PRODUCT DEVELOPMENT PROGRAM. W. H. Friske. Jan. 15, 1960. 34p. Contract AT-11-1-GEN-8. OTS.

Because of their good elevated temperature strength properties, aluminum powder metallurgy (APM) products have application in organic cooled reactors. Tensile and creep investigations have confirmed the superiority of APM alloys over conventional, wrought aluminum alloys, in the temperature range of 800 to 1000°F. However, the resultant strength values are significantly lower than previously reported. Cold working may also lower the elevated temperature strength of APM alloys. Alloy M257 has been successfully extruded into externally-finned, thin-walled, small-diameter tubing. End closures in M257 tubes have been successfully made by fusion welding unalloyed aluminum end plugs and by flash welding M257 end plugs. After prolonged heating at 1100°F, no evidence of a reaction between UO_2 pellets and M257 has been found. APM products are compatible with organic coolants at 750°F. (auth)

6613 NASA-TN-D-260

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

CONTINUED STUDY OF ADVANCED-TEMPERATURE NICKEL-BASE ALLOYS TO INVESTIGATE VANADIUM ADDITIVES. John C. Freche, Thomas J. Riley, and William J. Waters. Feb. 1960. 34p. OTS.

An investigation was conducted to extend the useful temperature range of a series of previously developed advanced-temperature nickel-base alloys that do not require vacuum-melting techniques. As-cast alloys with improved rupture and impact properties resulting from additions of vanadium and carbon, as well as tungsten, vanadium, and carbon, were evolved. The strongest composition displayed 768-, 301-, and 101-hour as-cast rupture lives at 15,000-psi stress and temperatures of 1800, 1850, and 1900 F, respectively. (auth)

6614 NGTE-M-145

Gt. Brit. National Gas Turbine Establishment, Farnborough, Hants, England.

A THEORETICAL NOTE UPON THE MECHANISM OF DEPOSITION IN TURBINE BLADE FOULING. M. C. G. Smith. Feb. 1952. 40p.

Modes by which deposition is likely to occur, such as by direct impact, vapor diffusion, and Brownian movement of small liquid or solid particles, are considered in detail. Data are presented from which it is possible to estimate the quantity of fouling matter reaching the surface provided its state, concentration, and the size of particles are known. No particles smaller than 0.25 micron in diameter are likely to deposit by direct impact, while all particles greater than 10 microns diameter will probably hit the nose or concave surfaces of the blade. A tentative working rule is proposed from which the percentage catch by direct impact on turbine blades can be estimated. For particles of 0.001 micron diameter, a deposited layer may grow at the rate of 0.001 in. per hour of running time. Deposition from vaporized ash will proceed more rapidly. The deposition through a turbulent boundary layer is heavier than in the laminar case. Finally, the laminar boundary layer equations are solved for the case of diffusion to a porous flat plate with air injection; and it is predicted that moderate injection will entirely prevent diffusive deposition in the laminar flow regions of the blade, and probably in the turbulent flow regions as well. Injection will reduce slightly the chances of deposition by direct impact. (auth)

6615 NP-8214

New York. State Univ. Coll. of Ceramics, Alfred.

SEMICONDUCTING MATERIALS. Annual Report [for] December 1958–November 1959. 70p. Project No. NR 015-215. Contract Nonr-1503(01).

In making photoconductivity measurements, a number of samples of both single crystal and polycrystalline refuse to respond in the test unit. Storage in the dark was found to help restore photoconductivity. The semiconductors which are being actively studied are CdSe, ZnTe, HgSe, HgTe, Bi_2Se_3, and Bi_2Te_3. Most measurements were performed on CdTe. The phosphides and arsenides were surveyed to determine which members not among the standard semiconductors might warrant future investigation. A summary of this survey is presented even though no compounds of these families were made. A general study was made of thermoelectric effects. (W.L.H.)

6616 ORO-229

Union Carbide Metals Co., Niagara Falls, N. Y.

COLUMBIUM CLAD URANIUM CARBIDE FUEL ELEMENT CONTACT. Monthly Letter Report [for] September 1 through September 30, 1959. 2p. Contract AT(40-1)-25[illegible] OTS.

Investigations of UC production by reaction of carbon and metal in an induction furnace, by carbon reduction of UO_2 in a vacuum furnace, and by the reaction of methane with powdered U in a gas-solid reactor are described. Characteristics of the products from these processes are described. Efforts to cold press and sinter UC pellets to a satisfactory density met only limited success. Eight samples were cold pressed at 20,000 to 160,000 psi. The green densities were 9.27 to 10.73, and a set of pellets sintered in vacuum at 2050°C for two hours showed an increase in density (9.6 to 10.8 g/cc). Other experiments produced densities of 10.77 to 11.82 g/cc, the higher densities were attributed to finer particle sizes in the samples. A preliminary diffusion experiment is reported in which a cold-pressed and sintered pellet of UC was incorporated into a diffusion couple with Nb and Nb–Zr alloy. The degree of reaction was small and future studies are planned for longer times and higher temperatures. (J.R.D.)

6617 UCRL-5709

California. Univ., Livermore. Lawrence Radiation Lab.

HYDROCLIMATOLOGY AND SURFACE HYDROLOGY OF SAN CLEMENTE ISLAND. Joseph B. Knox and Harlan Zodtner. Oct. 12, 1959. 22p. Contract W-7405-eng-48. OTS.

An evaluation was made of San Clemente Island as a potential site for application of Plowshare techniques for the creation of an underground reservoir to assure an adequate water supply. Methodology is developed for evaluating hydroclimatology and surface hydrology in relation to the design of possible aquifer experiments. (C.H.)

6618 WADC-TR-59-300

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

RESEARCH AND DEVELOPMENT SERVICES LEADING TO THE CONTROL OF ELECTRICAL PROPERTIES OF MATERIALS FOR HIGH TEMPERATURE RADOMES. [Period covered] July 1, 1958 to April 30, 1959. Leon M. Atlas. May 1959. 32p. Project title: ELECTRICAL AND ELECTRONIC MATERIALS. Task title: ELECTRICAL AND ELECTRONIC INORGANIC MATERIALS. Contract AF33(616)-5929. OTS.

Methods are described for the preparation of high purity aluminum oxide (less than 100 ppm of impurities) by the solution of 99.999% Al metal in hydrochloric acid and pre-

cipitation with ammonia. After calcining at 1400°C, this batch was fabricated into ceramics by firing in air at temperatures up to 1900°C. Loss tangents at 500°C approach that of sapphire, and the temperature variation of dielectric constant is considerably lower than for high purity commercial aluminas. Defects in alumina ceramics produced by impurities and by interactions with gaseous atmospheres have been studied by measuring the reflectance and thermoluminescence of gamma irradiated specimens. (auth)

6619 WADC-TR-59-338

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

COMPOSITE INORGANIC RESILIENT SEAL MATERIALS. [Period covered] May 1958 to May 1959. M. Sabanas. June 1959. 94p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: ELASTOMERIC AND COMPLIANT MATERIALS. Contract AF33(616)-5793.

Research was conducted on essentially inorganic seal materials exhibiting the desirable characteristics common to elastomers, combined with temperature and fluid resistance to at least 1000°F. Materials exhibiting this behavior are a prerequisite to the design concept of power transmission systems for future flight vehicles. Experimental screening tests were performed on composite refractory materials to provide leads for new materials for ultimate static and dynamic seal applications. Of the numerous refractory material composites tested, the graphite and molybdenum disulfide combination approached the target objectives, but were rapidly oxidized in an air atmosphere at 1000°F. Materials consisting of stainless steel and molybdenum fibers made into a bonded skeleton of the desired shape and impregnated with various soft ductile phases, were fabricated and their properties studied. The properties of these composites differ from the base metals from which they are made, since the geometrical configuration imparts an elastomeric like behavior to the composite. A longer period of research would be required for further experimental study to explore all the possibilities that these new composite materials offer. (auth)

6620 WADC-TR-59-390

Crucible Steel Co. of America, Pittsburgh.

DEVELOPMENT OF A CORROSION-RESISTANT BEARING STEEL FOR SERVICE IN AIRCRAFT AT TEMPERATURES UP TO 1000 F. [Period covered]: April 1958 to July 1959. G. Steven and T. V. Philip. July 24, 1959. 68p. Project title: METALLIC MATERIALS. Task title: REFRACTORY METALS. Contract AF33(616)-5428. OTS.

Corrosion resistance has been added to the high initial hardness, adequate temper resistance (600 to 900°F), and good dimensional stability of a high-speed type bearing alloy. To produce secondary hardening, the base composition of a quench hardenable stainless steel, 440C, was modified with V, W, Mo, and Co. The following composition is recommended for use as a stainless bearing steel for 500 hr of operation up to 900°F: 1.10 to 1.15% C, 0.15% max Mn, 0.15% max Si, 13.5 to 14.5% Cr, 2.5 to 3.0% V, 2.0 to 2.5% W, 3.75 to 4.25% Mo, and 5.0 to 5.5% Co. For best performance, the steel should be heat-treated as follows: heat to 2200°F, oil quench, and refrigerate to −105°F. Rockwell "C" 66 is achieved (2% retained austenite) by tempering the steel for 1+1+2 hr at 1000°F with intermediate subzero cooling after the first and second draws. Tempering twice for 2 hr at 1000°F also results in a useful structure. After 500 hr at 900°F the hardness drops to R_c 65 (hot hardness of R_c 57), and the structure contracts 13 μin./in. After three cycles of a water-vapor corrosion test, the surface of fully heat-treated WADC66 is only slightly more pitted than that of annealed 430 stainless steel. (auth)

6621 WAPD-214

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

DEVELOPMENT AND PROPERTIES OF SILVER-BASE ALLOYS AS CONTROL ROD MATERIALS FOR PRESSURIZED WATER REACTORS. I. Cohen. Dec. 1959. 122p. Contract AT-11-1-GEN-14. OTS.

The metallurgical design and properties of silver-base alloys which show considerable promise of fulfilling metallurgy, physics, and mechanical design requirements of control rods for nuclear pressurized water reactor plant service are described. By extension of the Hume-Rothery electron concentration rule, ternary and quaternary Ag-base alloys were designed for metallurgical stability, and their physics worth, corrosion, and physical and mechanical properties were determined. Of particular interest is the Ag + 15 wt.% In + 5 wt.% Cd alloy which is comparable to hafnium in neutron absorption characteristics. (auth)

6622 AERE-Trans-840

METHODS OF STUDYING DIFFUSION BY MEANS OF RADIOACTIVE ISOTOPES. J. Čádek and E. Janda. Translated by R. G. Evan (Atomic Energy Research Establishment) from Hutnické listy 12, 1008-20(1957). 38p.

This paper was previously abstracted from the original language and appears in NSA, Volume 13, as abstract no. 21156.

6623 CEA-tr-R-757

DÉPOSITION D'UNE COUCHE RADIOACTIVE PAR LA MÉTHODE D'EVAPORATION SOUS VIDE POUR LES ÉTUDES DE DIFFUSION. (Deposition of a Radioactive Layer by the Vacuum Evaporation Method for Diffusion Studies). V. I. Izvekov. Translated into French by B. De Trezvinsky from Pribory i Tekh. Eksp. 2, 111-12(1957). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 8475.

6624

RESULTS AND PROBLEMS OF REACTOR GRAPHITE DEVELOPMENT IN GERMANY. [PART] II. E. Fitzer, M. Beutell, E. Nedopil, and K. W. S. Etzel (Siemens-Planiawerke AG für Kohlefabrikate, Meitingen, Ger. and Farbwerke Hoechst, Werk Griesheim, Frankfurt am Main). Atomkernenergie 4, 476-80(1959) Dec. (In German)

In the second section of this paper the properties of nuclear graphite are discussed with a consideration of the purity, neutron cross sections, and activity. The behavior of graphite under neutron irradiation is described. Briefly, the problems still to be solved in Germany on the production of reactor graphite are reviewed. (J.S.R.)

6625

THE SYSTEM ZIRCONIUM–SELENIUM. Harry Hahn and Peter Ness (Universitat, Kiel). Z. anorg. u. allgem. Chem. 302, 37-49(1959) Nov.

In addition to $ZrSe_2$ hitherto known as the only compound in the system zirconium-selenium, the compounds $ZrSe_3$ (monoclinic) and Zr_4Se_3 (tetragonal) as well as the phases Zr_3Se_4 (rhombohedrally distorted NaCl-structure with a range of homogeneity from $ZrSe_{1.0}$ to $ZrSe_{1.4}$) and Zr_3Se_2 (WC-type with the composition range from $ZrSe_{0.6}$ to $ZrSe_{0.8}$) have been found. (auth)

6626

IMPROVED SOURCE OF RADIOACTIVE ENERGY, AND METHOD OF PRODUCING THE SAME. Paul Alexi. British Patent 817,895. Aug. 6, 1959.

A description is given of radioactive sources of radioisotopes dispersed in graphite or carbon or mixtures of carbon with ceramic or vitreous materials. After com-

pressing the dispersion into the desired shape, a suitable coating of metal, varnish, glaze, or enamel is applied. (T.R.H.)

6627

IMPROVEMENTS IN OR RELATING TO METAL COATINGS. Leslie Mark Wyatt (to United Kingdom Atomic Energy Authority). British Patent 818,312. Aug. 12, 1959.

A process for applying metal coatings to UO_2 is described which uses metal powder. The powder Be for example, is pressed into two steel trays to form a lining. A flat plate of sintered UO_2 is placed between the trays, and the whole is welded, evacuated, and sealed off. This assembly is then put in a die and heated to 1100°C and pressed to 2000 psi. On cooling the assembly with its smooth Be coating is removed and cleaned with HNO_3. A thicker steel tray may be used, and then be removed by machining. (T.R.H.)

6628

IMPROVEMENTS IN AND RELATING TO ALLOY STEELS. Eric Winearls Colbeck and Thomas Harold Middleham (to Hadfields, Ltd.). British Patent 826,466. Jan. 6, 1960.

High-boron steels are described in which loss of workability is compensated by addition of Al. These steels have permissible radiation characteristics and were found to be forgeable by light hammering with slow cross sectional area reduction. Several suitable compositions are cited which have small amounts of C, Si, and Mn, and B and Al contents ranging from 3.02 and 0.44 to 4.20 and 2.3%, respectively. (T.R.H.)

6629

METHOD OF DISINTEGRATING REFRACTORY BODIES. R. P. Larsen and R. C. Vogel (to U. S. Atomic Energy Commission). U. S. Patent 2,900,230. Aug. 18, 1959.

A method is described for disintegrating uranium dioxide and other oxide fuel elements of the compacted type. The method consists of immersing them in liquid alkali metal long enough to form surface cracks, removing them from the metal bath, and immersing them in nitric or some other mineral acid.

6630

PLUTONIUM–CERIUM–COBALT AND PLUTONIUM–CERIUM–NICKEL ALLOYS. Arthur S. Coffinberry (to U. S. Atomic Energy Commission). U. S. Patent 2,901,345. Aug. 25, 1959.

New plutonium-base ternary alloys useful as liquid reactor fuels are described. The alloys consist of 10 to 20 atomic percent cobalt with the remainder plutonium and cerium in any desired proportion, with the plutonium not in excess of 88 atomic percent; or, of from 10 to 25 atomic percent nickel (or mixture of nickel and cobalt) with the remainder plutonium and cerium in any desired proportion, with the plutonium not in excess of 86 atomic percent. The stated advantages of these alloys over unalloyed plutonium for reactor fuel use are a lower melting point and a wide range of permissible plutonium dilution.

6631

NICKEL–CHROMIUM–GERMANIUM ALLOYS FOR STAINLESS STEEL BRAZING. J. A. McGurty and E. S. Funston (to U. S. Atomic Energy Commission). U. S. Patent 2,901,347. Aug. 25, 1959.

A new ternary brazing alloy consisting of from 37 to 65 wt.% nickel, from 5 to 40 wt.% chromium, and from 15 to 40 wt.% germanium is described.

6632

COATING METHOD. R. G. Townsend (to U. S. Atomic Energy Commission). U. S. Patent 2,901,408. Aug. 25, 1959.

A method is described for protectively coating beryllium metal by etching the metal in an acid bath, immersing the etched beryllium in a solution of sodium zincate for a brief period of time, immersing the beryllium in concentrated nitric acid, immersing the beryllium in a second solution of sodium zincate, electroplating a thin layer of copper over the beryllium, and finally electroplating a layer of chromium over the copper layer.

6633

ALLOY COMPOSITIONS. Robert L. Reed (to U. S. Atomic Energy Commission). U. S. Patent 2,902,361. Sept. 1, 1959.

A corrosion-resistant binary uranium–tantalum alloy for use in reactors, the tantalum content of which ranges from 0.5 to 15% by weight, is described.

6634

PLUTONIUM–URANIUM ALLOY. A. S. Coffinberry and F. W. Schonfeld (to U. S. Atomic Energy Commission). U. S. Patent 2,902,362. Sept. 1, 1959.

Pu–U–Fe and Pu–U–Co alloys suitable for use as fuel elements in fast breeder reactors are described. The advantages of these alloys are ease of fabrication without microcracks, good corrosion resistance, and good resistance to radiation damage. These advantages are secured by limitation of the zeta phase of plutonium in favor of a tetragonal crystal structure of the U_6Mn type.

6635

SLIP CASTING METHOD. A. G. Allison (to U. S. Atomic Energy Commission). U. S. Patent 2,902,380. Sept. 1, 1959.

A process is described for preparing a magnesium oxide slip casting slurry which when used in conjunction with standard casting techniques results in a very strong "green" slip casting and a fired piece of very close dimensional tolerance. The process involves aging an aqueous magnesium oxide slurry, having a basic pH value, until it attains a specified critical viscosity at which time a deflocculating agent is added without upsetting the basic pH value.

6636

THORIUM–BERYLLIUM ALLOYS AND METHOD OF PRODUCING SAME. F. H. Spedding, H. A. Wilhelm, and W. H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,903,351. Sept. 8, 1959.

The preparation is described of thorium–beryllium alloys from halides of the metals by simultaneously reducing thorium fluoride and beryllium fluoride with calcium at approximately 650°C and maintaining the temperature until the thorium–beryllium alloy separates from the slag.

6637

RADIOACTIVE OBJECT AND METHOD OF MAKING SAME. L. M. Dorfman and F. J. Shipko (to U. S. Atomic Energy Commission). U. S. Patent 2,903,383. Sept. 8, 1959.

A process is described for depositing an adherent coating of tritiated cuprene upon a solid body at the bottom of a vessel by introducing an atmosphere into the vessel containing a large fraction of tritiated acetylene whereby tritiated cuprene forms by polymerizing action and is deposited on the body by the action of gravity. An adherent, evenly distributed coating is obtained.

6638

ELECTROLYTIC CLADDING OF ZIRCONIUM ON URA-

NIUM. J. J. Wick (to U. S. Atomic Energy Commission). U. S. Patent 2,905,599. Sept. 22, 1959.

A method is presented for coating uranium with zirconium by rendering the uranium surface smooth and oxide-free, immersing it in a molten electrolytic bath in NaCl, K_2ZrF_6, KF, and ZrO_2, and before the article reaches temperature equilibrium with the bath, applying an electrolyzing current of 60 amperes per square decimeter at approximately 3 volts to form a layer of zirconium metal on the uranium.

6639

PROCESS FOR PRODUCTION OF URANIUM. J. W. C. Crawford (to U. S. Atomic Energy Commission). U. S. Patent 2,906,618. Sept. 29, 1959.

A process is described for the production of uranium by the autothermic reduction of an anhydrous uranium halide with an alkaline earth metal, preferably magnesium. One feature is the initial reduction step which is brought about by locally bringing to reaction temperature a portion of a mixture of the reactants in an open reaction vessel having in contact with the mixture a lining of substantial thickness composed of calcium fluoride. The lining is prepared by coating the interior surface with a plastic mixture of calcium fluoride and water and subsequently heating the coating in situ until at last the exposed surface is substantially anhydrous.

6640

WELDING METHOD. A. A. Cornell, J. V. Dunbar, and J. H. Ruffner (to U. S. Atomic Energy Commission). U. S. Patent 2,906,852. Sept. 29, 1959.

A semi-automatic method is described for the weld joining of pipes and fittings which utilizes the inert gas-shielded consumable electrode electric arc welding technique, comprising laying down the root pass at a first peripheral velocity and thereafter laying down the filler passes over the root pass necessary to complete the weld by revolving the pipes and fittings at a second peripheral velocity different from the first peripheral velocity, maintaining the welding head in a fixed position as to the specific direction of revolution, while the longitudinal axis of the welding head is disposed angularly in the direction of revolution at amounts between twenty minutes and about four degrees from the first position.

Corrosion

6641 AERE-R-3029

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE OXIDATION AND CORROSION OF ZIRCONIUM AND ITS ALLOYS. VII. EXPERIENCE WITH HIGH PRESSURE EQUIPMENT FOR USE WITH AQUEOUS SOLUTIONS AT HIGH TEMPERATURE. K. Alcock and B. Cox. Sept. 1959. 24p. BIS.

The experience with high-pressure equipment which was obtained during corrosion studies in homogeneous aqueous reactor solutions is discussed. Details are given of high-pressure equipment which was designed and operated successfully, and the merits of individual designs are considered. Details are given of the experimental procedures which were adopted for corrosion testing out-of-pile. (auth)

6642 TID-5090

[Columbia Univ., New York].

ANODIZATION OF STEEL IN A FLUORIDE BATH. Homer F. Priest and M. Levitz. Feb. 10, 1943. Decl. Nov. 23, 1959. 2p. (KIDM-30). OTS.

To protect the laminations of motors from UF_6 attack, an anodization procedure in a fused salt bath using a steel cathode is described. (T.R.H.)

6643 WAPD-CTA(MEE)-615

Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.

INTERIM REPORT ON MINIATURE MOTOR TUBE TESTS. Task E-4C. K. Jakobson and E. Rau. Oct. 10, 1958. 34p. OTS.

Failure occurred in chrome plated thimbles tempered at 650°F and having a hoop stress of 60,000 psi. These thimbles were manufactured from material which would have been acceptable for motor tube production. No failures have occurred to the present in bare thimbles manufactured from the same material. The failures were similar to those which occurred in beam specimen tests. In both cases the cracks were intergranular in nature. The cracks in the chrome plated thimbles occurred beneath cracks in the chrome plate. The phenomena were also noted in the beam specimen tests. Elongated defects called slits were present in the thimbles fabricated from Ht. 02826. These varied in depth from fractions of a mil to as much as 5 mils. If the slits opened to the primary water surface, they definitely appeared to serve as site for crack origination. The failure of the thimbles initiated in such a way that a slow leak occurred rather than a disasterous failure. In submarine reference water (O_2 0.1 ppm) once a crack was initiated it propogated slowly so that a number of days was usually required before system pressure could no longer be maintained. In all cases except one, only one crack formed which eventually penetrated the wall. One other specimen developed an additional crack upon further exposure. In addition some intergranular attack was noted in the thick-walled portion of some thimbles. (auth)

6644 AEC-tr-3955

ON THE THICKNESS OF OXIDE FILMS ON SOME METALS FROM THE DATA OF ELECTRON DIFFRACTION AND OPTICAL INVESTIGATIONS. V. V. Andreeva and N. A. Shishakov. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Fiz. Khim. 32, 1671-2(1958). 4p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 240.

6645

CORROSION MECHANISMS IN THE REACTION OF STEEL WITH WATER AND OXYGENATED SOLUTIONS AT ROOM TEMPERATURE AND 316°C. Mary Boehm Strauss and M. C. Bloom (U. S. Naval Research Lab., Washington, D. C.). J. Electrochem. Soc. 107, 73-9(1960) Feb.

The corrosion products developed by steel when reacting with water of varying oxygen content at room temperature and at 316°C are described. The reaction was carried out in sealed steel capsules and followed by pH measurement of the solution and by microscopic, x-ray, and electron diffraction analysis of the corrosion product films. Data on the transformation behavior of the corrosion products involved and a summary of some of their physical properties are included. (auth)

6646

THE KINETICS OF THE CORROSION OF LOW-HAFNIUM ZIRCONIUM IN AQUEOUS SULFURIC ACID SOLUTIONS. Tennyson Smith (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). J. Electrochem. Soc. 107, 82-6(1960) Feb.

The rates of corrosion of low-hafnium zirconium in aqueous sulfuric acid solutions over the concentration range 9 to 97% by weight, were studied. Corrosion was

detected by measuring the concentration of zirconium in solution with a radioactive tracer, Zr^{95}. The samples first were etched in an aqueous hydrofluoric-nitric acid solution, then placed directly into the sulfuric acid solution. The initial corrosion followed a parabolic rate law which was followed by a constant rate. Corrosion during the constant reaction rate period was faster, by an order of magnitude or more than rates previously reported for unetched samples under similar conditions. This is thought to be due to the removal of the protective oxide film on etching and the subsequent growth of some less protective film in the sulfuric acid solution. The corrosion rate was found to be first-order with respect to undissociated sulfuric acid over the concentration range 0.2 to 9M of "undissociated sulfuric acid," [31.4 to 81.1% H_2SO_4 by weight]. An equation relating the corrosion rate and the concentration of undissociated sulfuric acid at 44°C and with pre-etching, is: $R = 4.0 \times 10^{-5} \times (H_2SO_4) + 1.0 \times 10^{-5}$ (g cm^{-2} hr^{-1}). An approximate value for the activation energy determined over the temperature range 20 to 72°C, is 7 to 8 kcal $mole^{-1}$. A discussion of possible mechanisms is given. (auth)

6647

OXIDATION RATES OF K AND Rb BETWEEN −79°C AND −20°C. J. V. Cathcart and G. P. Smith (Oak Ridge National Lab., Tenn.). J. Electrochem. Soc. 107, 141-2(1960) Feb.

Oxidation rates were measured at −79, −50, and −20°C for K and at −79 and −50°C for Rb. The maximum film thicknesses of 2000 to 3000 A were obtained for K at −20°C and at −50°C for Rb. The oxide films formed on K and Rb at −50 and −79°C were almost completely protective, but at −20°C a transition from protective to nonprotective oxidation was observed. The temperature at which this transformation was observed varied inversely with the electropositive character of the metals. (C.J.G.)

6648

AFFECTING THE HOT WATER CORROSION OF ZIRCONIUM WITH PALLADIUM. Hans-Walter Schleicher (Metallgesellschaft AG., Frankfurt am Main). Z. Metallk. 50, 687-90(1959) Dec. (In German)

It was detected that small additions of palladium improve the corrosion resistance of zirconium in high-temperature water and steam. Pertinent tests showed that coupling of zirconium with palladium effects an improvement too. Testing procedures are described and results are discussed as to possible underlying mechanisms. (auth)

Fabrication

6649 AD-210451

Brush Beryllium Co., Cleveland.

FABRICATION OF BERYLLIUM WIRE. Progress Report No. 1 [for] October 16, to December 15, 1958. A. G. Gross, Jr., R. G. O'Rourke, and W. W. Beaver. 15p. Contract NO(as)-59-6030-C.

Development of techniques for fabrication of Be wire was initiated. First drawing attempts will be made on centerless ground 0.25 in. Be rod. A method of evaluating wire-drawing procedures was developed. A strain bar was fabricated from stainless steel, and fixtures to adapt this equipment to a drawbench are under construction. A mathematical analysis of the wire-drawing process is presented, and a summary of the assumptions required for this analysis is listed. (J.R.D.)

6650 BMI-APDA-644

Battelle Memorial Inst., Columbus, Ohio.

STUDIES FOR THE PREPARATION OF ZIRCONIUM-CLAD URANIUM-10 w/o MOLYBDENUM FUEL PINS. John B. Fox, Donald M. Cheney, Arthur A. Bauer, and Ronald F. Dickerson. Oct. 27, 1958. 37p. For Atomic Power Development Associates, Inc., Detroit.

Production methods for producing an homogeneous uranium-10 wt.% molybdenum fuel-alloy pin with a uniform zirconium cladding have been studied. The effect of various impurities has been investigated and the nature of and methods for eliminating cracking in swaged fuel pins have been examined. A major portion of the results is based on the study of material produced from 25-lb ingot castings. Small experimental-scale ingots were also employed in impurity, heat-treatment, and cracking studies. On the basis of the data obtained recommendations concerning casting, fabrication, and heat-treatment techniques necessary to produce a fuel pin of satisfactory integrity are presented. Specifications as to allowable carbon, chromium, iron, nickel, oxygen, and zirconium content are recommended. (auth)

6651 BMI-X-127

Battelle Memorial Inst., Columbus, Ohio.

URANIUM DIOXIDE–STAINLESS STEEL SPECIMENS FOR IRRADIATION IN SODIUM—EXPERIMENT PW-5-1. G. D. Calkins, M. Pobereskin, J. R. Keeler, and D. L. Keller. Apr. 25, 1955. Decl. Jan. 12, 1960. 19p. OTS.

The preparation, pre-irradiation testing, and encapsulation of stainless–UO_2 cored, plate-type fuel elements for irradiation in stagnant sodium are discussed. The eight specimens for Experiment PW-5-1 are examined. (auth)

6652 NAA-SR-Memo-3299

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

MECHANICAL ASSEMBLY FABRICATION OF OXIDE FUEL ELEMENT. E. F. Cook. Dec. 1, 1958. 22p. OTS.

Mechanical techniques for oxide fuel element fabrication were investigated. For the assembly technique study, full scale mechanical mock-ups were prepared including a 19-rod cluster, a 55-rod cluster wire grid spaced, and a concentric tubular element. Procedures common to fuel element fabrication were used with negligible difficulty, however, it was found that a process tube will be required for the 19-rod element to achieve structural rigidity and maintain reasonable fuel rod spacing within the cluster. Drawings and photographs are included. (J.R.D.)

6653 NMI-5006

Nuclear Metals, Inc., Concord, Mass.

INVESTIGATION OF FABRICATION AND FORMABILITY PROCESSES FOR STRUCTURAL BERYLLIUM SHEET. Final Report to the Martin Company. F. M. Yans. Apr. 30, 1959. 36p. Contract AF33(616)-5180, Subcontract No. 8H0396. OTS.

The effect of reduction in upsetting on the uni-axial and bi-axial elongation of upset beryllium sheet was determined. The effect of fabrication temperature on the pressure required for upsetting and the yield strength of the resulting sheet was evaluated. The first beryllium load bearing structural assembly was made from 20-inch diameter upset sheet. This sheet was successfully drilled, formed, and riveted in the process of fabricating the above structural assembly. (auth)

6654 NP-8279

Mallory-Sharon Metals Corp., Niles, Ohio.

THE ELECTRON BEAM MELTING OF BERYLLIUM, BORON, BORON CARBIDE, TANTALUM CARBIDE, TITANIUM CARBIDE, TUNGSTEN, AND ZIRCONIUM DIBORIDE. Quarterly Progress Report No. 6 [for] August 1–October 31, 1959. S. R. Seagle and O. Bertea. Nov. 1959. 15p. Contract AF33(616)-5603.

Electron beam melting and evaluation of boron, boron carbide and silicide, tantalum carbide, titanium carbide, and zirconium boride produced materials which were either brittle or not meltable. Electron beam melting of Be metal was conducted and the ductility of extrusions from these ingots appeared to be related to the method of melting (melting ratio). Data on the chemical composition of the ingots are included. Progress is reported in the electron beam melting of Hf. Four electrodes were made of Hf sponge, three of which were electron beam melted while the fourth was arc melted. Data on hardness of electron beam melted samples are tabulated. Other metals such as V, Co, and Mo are being procured for similar investigations. Plans for studies of deoxidation during electron beam melting are outlined, and the procurement of Be to be prepared for melting is reported. Also orders for Y, Co, Mo, Th, and B were placed. Plans for research during the next quarter are included. (For preceding period see NP-7929.) (J.R.D.)

6655 SEP-159

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

PERFORATED WAFER FUEL ELEMENTS. H. S. Kalish, E. N. Mazza, and G. Zuromsky. Sept. 13, 1954. Decl. Dec. 15, 1959. 25p. Contract AT(11-1)-229. OTS.

A method of compacting perforated wafers from a mixture of stainless steel and 30 wt.% UO_2 is described. A die containing 68 core pins was constructed to compact wafers $\frac{5}{8}$ in. square, $\frac{1}{4}$ in. thick containing 68 holes. These holes are 0.068 in. in diameter and the distance between adjacent holes is 0.012 in. From results obtained it appears feasible to attempt compacting of these wafers in an automatic press which would permit a high rate of production. The wafers are sintered, stacked together and stainless steel tubes through which the heat transfer liquid is to flow are inserted. Techniques were developed to effect suitable bond between the tubes and wafers. The wafer-tube assembly is jacketed with a square stainless steel tube and end closure effected by local heliarc welding. The feasibility of this method for making fuel elements of UO_2 in other metal matrices or from a uranium alloy is described. Preliminary calculations indicate that the perforated wafers can be used to make solid fuel elements with a large amount of cooling surface at low cost, in high production if necessary, and with a high degree of U^{235} economy. (auth)

6656 TID-3542

Technical Information Service Extension, AEC.

BERYLLIUM—FABRICATION AND JOINING. A Literature Search. Raymond L. Scott, comp. Jan. 1960. 14p. OTS.

This search, containing 128 references, was prepared to serve as a guide to the report literature on the fabrication and joining of Be. (W.L.H.)

6657 WADC-TR-58-674

Sylvania-Corning Nuclear Corp., Bayside, N. Y.

THE CLADDING AND WELDING OF STAINLESS STEEL TO MOLYBDENUM AND NIOBIUM. Joseph Fugardi and John L. Zambrow. Oct. 1959. 41p. Project No. 7308. Contract AF33(616)-3492.

Methods were investigated for the fabrication of composite sheets consisting of 310 stainless steel bonded to one side of either Mo or Nb sheet. A barrier material between the two sheets was used to minimize diffusion. The best barrier material found, on the basis of tensile strength, thermal shock resistance, minimum diffusion during long time high-temperature tests and minimum formation of intermetallic compounds at the bonding surfaces, was nickel for the Mo to type 310 stainless steel composite and iron for the niobium to type 310 stainless steel composite. Butt welds were made on composite sheets of stainless-molybdenum and stainless-niobium. The difference in the thermal coefficient of expansion between the stainless and the refractory metals used caused stresses and distortion in the weldments. (auth)

6658

EVALUATING EXPLOSIVE METAL FORMING. C. P. Williams (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). J. Metals 12, 33-6(1960) Jan.

High explosive, open-die forming appears best suited, economically and practically, to low-volume production of relatively large parts. The correlation that low explosive closed-die forming should be mainly applicable to high-volume production of comparatively small-parts seems to be valid. A new concept for the fabrication of metal parts was conceived, and there were sufficient demonstrations of the merits of the process to believe that the concept has commercial value. (B.O.G.)

6659

ELECTRON BEAM WELDING. A COMPARISON WITH CONVENTIONAL SHIELDED-ARC METHODS. N. F. Eaton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nuclear Eng. 5, 19-22(1960) Jan.

The major use of this process is in the nuclear reactor fuel element field. The prevention of atmospheric contamination is perhaps the most important advantage the process has over conventional welding methods. The electron beam method is capable of a much higher heat input per unit area than arc welding. This allows thicker sections to be welded, allows very thin sections to be welded conveniently to other thin sections or to very thick sections, and allows the use of a small spot which minimizes vapor loss from the molten pool. Use of the pulsed heat technique, together with a vacuum pumping system of high capacity, minimizes the change of discharge breakdown. Considering only consumable items, the cost of welding 1,000 fuel elements over a 24-hour period is about $1.00 for the electron beam process and $7.00 for inert gas shielded tungsten arc on conventional welding. The electrical design considerations are presented for three methods. The equipment in use at AWRE is discussed, and examples of the electron beam welds are shown. (B.O.G.)

6660

PROCESS FOR THE MANUFACTURE OF AN ENCASED FUEL ELEMENT FOR NUCLEAR REACTORS. (to Deutsche Gold-und Silber-Scheideanstalt vormals Roessler). British Patent 818,258. Aug. 12, 1959.

A method of cladding U with Zr is described. An electropolished U rod is put in a close-fitting Zr can. The can is then lowered, in high vacuum, through an induction furnace which melts the U and gives a good bond between fuel and cladding. (T.R.H.)

6661

IMPROVEMENTS IN OR RELATING TO THE ELECTROLYTIC COATING OF MAGNESIUM AND MAGNESIUM ALLOYS BY ANODIC TREATMENT. Mervin Wyndham Davies and William Eric Dennis (to General Electric Co., Ltd.). British Patent 825,458. Dec. 16, 1959.

An anodic treatment for Mg and Mg alloys to protect them when used as fuel element cans is described. The bath contains (in g/l) 120 KOH, 70 KF, 18 Al, and 35 $NaPO_4 \cdot 12H_2O$. A wide range of voltage-current-time conditions is possible. (T.R.H.)

6662
IMPROVEMENTS RELATING TO THE COATING OF ZIRCONIUM. Frank Henry Weller (to Associated Electrical Industries, Ltd.). British Patent 826,288. Dec. 31, 1959.

A corrosion-protective Mg coating for Zr and Zr alloys is presented. After cleaning, the Zr object is placed in a molten $ZnCl_2$ flux bath at 550°C. The Zn-coated Zr is washed with water and coated with Mg by dipping in molten Mg at 650 to 750°C. (T.R.H.)

Properties and Structure

6663 AECU-4605
Aeroprojects, Inc., West Chester, Penna.
THORIUM BISMUTHIDE—ULTRASONIC CONTROL OF CRYSTAL SIZE. May 16, 1959. 12p. OTS.

The crystallization of thorium bismuthide from a bismuth solution results in platelets which may be as large as 1 cm in diameter. Particle size can be reduced by very rapid cooling (~1000°C per sec) or ultrasonic treatment. Short ultrasonic treatments indicated energy requirements of 1.02 to 0.34 W-min per g. The corresponding power requirements for treating the LMFR blanket are 25.8 to 8.5 kw. (C.J.G.)

6664 AFOSR-TN-59-1181
California. Univ., Berkeley. Minerals Research Lab.
INTERNAL STRESSES IN MODEL CERAMIC SYSTEMS. II. A. X-RAY STRAIN MEASUREMENT TECHNIQUES FOR CERAMIC BODIES. Leonard N. Grossman and Richard M. Fulrath. B. EXTENDING THE RANGE OF REPLICATION TECHNIQUES. Robert B. Langston and Richard M. Fulrath. Technical Progress Report No. 2. Oct. 1, 1959. 36p. Contract AF49(638)-4.

X-ray-diffractometer techniques for measuring triaxial and biaxial strain in ceramic bodies are described. The results of the techniques as applied to model ceramic systems using Al_2O_3 and ThO_2 crystal phases with various glasses in the $Na_2O-B_2O_3-SiO_2$ system are presented. It is shown that internal stresses due to expansion coefficient mismatches occur in these systems and that their magnitudes often exceed the bulk strength of the body. Further applications of the techniques are discussed. (auth)

6665 BM-RI-5555
Bureau of Mines.
MOLYBDENUM CASTING DEVELOPMENT. E. D. Calvert, S. L. Ausmus, S. A. O'Hare, and A. H. Roberson. May 1959. 18p.

Casting molybdenum using an arc potential of 36 to 40 volts with a current of 10,000 amperes is reported. Properties on specimens cut from one centrifugally cast tube include tensile strength, 39,800 psi; yield strength, 35,300 psi; elongation, and reduction in area nil; impact strength, 2 ft–lb; and hardness, DPH 180. No mold reaction was noticed in machined graphite, however reaction was evident in rammed graphitic-base molds. (J.R.D.)

6666 BMI-787
Battelle Memorial Inst., Columbus, Ohio.
EVALUATION OF OXIDATION-RESISTANT CERAMICS FOR HIGH-TEMPERATURE REACTOR ELEMENTS. C. G. Harman, E. F. Ferrell, H. E. Wagner, and J. F. Quirk. Dec. 1, 1952. Decl. Dec. 15, 1959. 39p. For General Electric Co. through Contract W-7405-eng-92. OTS.

The properties of 23 refractory oxidation-resistant ceramic compounds are tabulated. The thermal stresses and heat throughput capacities for nine of these compounds are estimated for conditions of steady heat flow and uniform heat generation at 1500 to 2500°F. The compounds studied have macroscopic thermal-neutron-absorption cross sections lower than 0.2 per centimeter. Data concerning the high-temperature stability of uranium compounds are tabulated for those with melting points above 2450°F. (auth)

6667 BMI-952
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECTS OF CHEMICAL IMPURITIES ON THE QUALITY OF ROLLED URANIUM ROD. H. A. Saller, J. R. Keeler, and L. J. Cuddy. Oct. 1, 1954. Decl. Dec. 15, 1959. 18p. Contract W-7405-eng-92. OTS.

Thirty-four uranium ingots containing controlled amounts of carbon, nitrogen, and MgF_2 slag were cast, rolled, and examined to elucidate the relation between these impurities and the quality of the rolled rod. Carbon at 1400 ppm and nitrogen at 170 ppm, either singly or in combination, had no significant effect on the number of defects observed in the rolled rod. The quality of the rods, however, decreased with increasing amounts of slag. The amount of slag necessary to cause observable differences in the rod could not be detected on analysis, but was visible in the microstructure. (auth)

6668 CAL-KA-797-M-7
Cornell Aeronautical Lab., Inc., Buffalo.
SUMMARY REPORT ON DEVELOPMENT OF LEAN-ALLOY CHROMIUM–NICKEL STAINLESS STEELS FOR HIGH TEMPERATURE USE. J. Salvaggi and S. J. Guarnieri. June 30, 1953. 63p. Contract NOa(s)-52-368-c. (AD-50149).

A study was made to find relatively lean alloy compositions suitable for high-temperature jet-aircraft service. The austenitic chromium-nickel stainless steels, of the "18-8" variety with and without molybdenum, were used as base analyses to which were made additions of titanium, boron, vanadium, zirconium, nitrogen, and carbon. Evaluation of the 100-hour rupture life was made at 1500°F for a substantial quantity of such compositions prepared as 15-pound heats and rolled to approximately 0.050-inch sheet stock for rupture test purposes. The results on hot strength tests were made on titanium and boron added individually and in combination to the austenitic Cr-Ni stainless steels. While the nominal 100-hour rupture strength at 1500°F is in the range of 6000 to 9000 psi for the conventional chromium-nickel stainless steels, values of 18,000 to 20,000 psi were obtained for several of the titanium and boron modifications. A number of the stronger compositions demonstrated similar gains with respect to the base analysis at 1350°F. Several ferritic steel heats of the Cr-Mo variety with additions of titanium, boron, vanadium, and carbon were checked for 1200°F rupture strength. None of the compositions prepared were superior to any of the ferritic steels previously developed. (auth)

6669 GEAP-3201
General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
RELATIVE EFFECTIVENESS OF REACTOR CONTROL MATERIALS. Richard A. Becker and John L. Russell, Jr. July 20, 1959. 50p. Contract AT(04-3)-189. OTS.

The boron equivalence of high cross section elements for slab geometries was measured. Data were obtained for several thicknesses of 19 elements. Because the measurement consists of conventional relative worth determination of slabs of various sample materials, the data are presented as relative worths vs. sample surface density, as well as sample surface density vs. equivalent boron surface density. (W.L.H.)

6670 HW-8358(Rev.)
Hanford Works, Richland, Wash.
EFFECT OF HEAT TREATMENT OF THE STRUCTURE AND HARDNESS OF GAMMA EXTRUDED URANIUM. Final Report, Problem Assignment 2-M. R. M. Padden. Dec. 24, 1947. Decl. Dec. 15, 1959. 13p. Contract [W-31-109-Eng-52]. OTS.

Tests were conducted to determine the optimum time-temperature treatment for production of recrystallized grain structure in gamma extruded uranium. Study of approximately 160 samples revealed no definite time-temperature treatment that would consistently produce a complete or nearly complete recrystallized structure, and no definite correlation between hardness values and recrystallization was established. (J.R.D.)

6671 KAPL-2051
Knolls Atomic Power Lab., Schenectady, N. Y.
PREDICTION OF HIGH TEMPERATURE TENSILE AND CREEP PROPERTIES FROM HOT HARDNESS TESTS OF A Zr–Nb–Sn ALLOY. D. L. Douglass. Aug. 13, 1959. 11p. Contract W-31-109-Eng-52. OTS.

A method is described by which long-time creep properties can be predicted by using hot hardness data on a Larson-Miller, time-temperature parameter. The elevated-temperature tensile strengths and stress to cause 1% deformation in creep tests were plotted against the parameter P = T (C + log t) with values of the constant, C, 18 and 19 for tensile and creep data, respectively. A similar plot of hardness was made against the parameter, P, with a value of 20 being used for C. A cross plot of log hardness versus log tensile strength (and creep stress for 1% deformation) was made for equal values of the Larson-Miller parameter; it yielded a straight line. The master curve may be used to determine creep properties by measuring the hot hardness, finding the corresponding stress (and parameter value), and substituting various time-temperature combinations into the parameter equation. (auth)

6672 NAA-SR-4173
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MEASUREMENT AND INTERPRETATION OF ELECTRICAL PROPERTIES OF ZIRCONIUM HYDRIDE FOR HYDROGEN-TO-METAL RATIOS BETWEEN 1.5 AND 2. P. W. Bickel. Jan. 15, 1960. 12p. Contract AT-11-1-GEN-8. OTS.

Electrical resistivity and Hall effect measurements were carried out at 1.1 to 300°K on zirconium hydride for hydrogen-to-metal ratios ranging from 1.54 to 1.96. In addition, the thermoelectric power was determined at 0 to 100°C. The data support the belief that for these compositions zirconium hydride is a metallic compound. $ZrH_{1.96}$ exhibited a room temperature resistivity of 24.7 micro-ohm-cm, which is considerably less than the value (42.6 micro-ohm-cm) characteristic of high-purity zirconium. On the basis of an observed rapid decrease of electrical resistivity as ZrH_2 is approached, it is predicted that the thermal conductivity will increase rapidly as the hydrogen-to-metal ratio approaches 2. Hall coefficient measurements revealed majority hole conduction for a face-centered cubic sample ($ZrH_{1.54}$) and majority electron conduction for a face-centered tetragonal sample ($ZrH_{1.81}$). Plots of resistivity and thermoelectric power vs. composition exhibited maxima in the vicinity of $ZrH_{1.6}$, and x ray studies showed this composition to lie within a two-phase region. The data allow some speculation on the nature of the bonding in zirconium hydride. (auth)

6673 NAA-SR-Memo-2995
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY INVESTIGATION OF URANIUM COMPOUNDS FOR USE AS FUELS IN SODIUM GRAPHITE REACTORS. W. Robson and B. Webb. Aug. 12, 1958. 9p. OTS.

The binary compounds of U which appear feasible for use as fuel materials for sodium graphite type reactors are given along with data on melting points, densities, cross sections, crystal structure, and uranium content. (W.D.M.)

6674 NAA-SR-Memo-4591
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SURFACE AREA MEASUREMENT OF UO_2 POWDERS BY THE B.E.T. GAS ADSORPTION METHOD WITH KRYPTON AS THE ADSORBATE. T. Smith. October 30, 1959. 12p. OTS.

The surface areas of very small samples of UO_2 powders were measured to a precision of ±5 cm^2 with a deviation of ±1%. Repeated experiments on the same sample gave reproducible surface areas of ±5%. Comparison of the experimental correlation and the theoretical relation between surface area and particle size, show that the assumption of spherical particles is incorrect. A shape factor must be introduced to account for the irregular particle shape. The theoretical equation relating surface area and particle size is hyperbolic ($S = 6/\rho D$, where S is the surface area per gram, ρ is the density, and D is the average diameter) and yields a linear relationship in a log-log form, i.e., $\log S = -\log D + \log 6/\rho$. For a UO_2 powder $S = 0.547/D$ or; $\log S = -\log D - 0.262$. A log-log relationship for the experimental UO_2 data, averaged by the method of least squares is; $\log S = (-1.086 \pm 0.089) \log D + (0.2086 \pm 0.0227)$. An approximate relation between surface area and average particle diameter of UO_2 is; $S = 1.68/D$, so that the shape factor is $(1.68/0.547) = 3.07$. (W.L.H.)

6675 NASA-TN-D-190
National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.
EXPLORATORY INVESTIGATION OF SEVERAL COATED AND UNCOATED METAL, REFRACTORY, AND GRAPHITE MODELS IN A 3,800°F STAGNATION TEMPERATURE AIR JET. Otto F. Trout, Jr. Feb. 1960. 73p. OTS.

Hot air jet tests were made on models of molybdenum coated with chromium plating, chromium-nickel plating, Chromalloy W-2, nickel aluminide, molybdenum disilicide, zirconia molybdenum laminate, and alumina molybdenum laminate; models of various grades of graphite, silicon carbide bonded graphite, siliconized graphite, and graphite coated with chrome plating, zirconia molybdenum laminate, and alumina molybdenum laminate; ceramic models of titanium boride, silicon carbide, zirconium boride, siliconized boron, and phosphate bonded alumina chromia ceramic reinforced with molybdenum wire. (auth)

6676 NASA-TR-R-59
National Aeronautics and Space Administration Langley Research Center, Langley Field, Va.
PREDICTED BEHAVIOR OF RAPIDLY HEATED METALS IN COMPRESSION. Elbridge Z. Stowell and George J. Heimerl. 1960. 16p.

A phenomenological relation previously proposed for a metal in tension at elevated temperatures is applied to compression under rapid-heating conditions. Predictions are made of the behavior of 7075-T6 aluminum-alloy sheet in compression under unrestrained constant-stress condi-

tions and under completely restrained conditions for temperature rates from 0.1 to 100°F per second. (auth)

6677 NP-8209

[Eldorado Mining and Refining Ltd.] Research and Development [Div.], Port Hope, Ont.

GREEN SALT AND METAL RESEARCH MONTHLY REPORT [FOR] NOVEMBER 1959. M. W. Melvanin, R. J. McClure, and T. W. Zawidzki. 11p.

The major project was the Type III rod development program. The cast 1.5-in. diam. rods were rolled to 0.328 in. and the 1.5-in. by 2.5-in. ovals were rolled to 1.5-in. diam., then to 0.328 in. Examination of the rods after rolling is reported. Work is reported on a study to determine the form in which carbon is present in U metal. (W.L.H.)

6678 NP-8237

Fulmer Research Inst., Ltd., Stoke Poges, Bucks, England.

FINAL REPORT [ON MISCIBILITY GAPS IN Nb–U AND Nb–U–Zr SYSTEMS]. [1959]. 94p. Contract 62558-(24)-1770. (R-126/4).

The miscibility gap in the U–Nb system has been established using metallographic and x-ray techniques. The monotectoid temperature is placed at 640° ± 2°C and the composition limits at that temperature are 65 to 70 at.% Nb and 17.5 ± 1 at.% Nb. The 700, 650, and 600°C isothermal sections of the U–Nb–Zr system have also been investigated. Each of the miscibility gaps present in the limiting binary sections was found to be closed by additions of the third element. At 700°C the U–Zr gap is closed by addition of less than 5 at.% Nb. The behavior of the Zr–Nb gap is less certain owing to the sluggish reactions close to this binary system but the gap appears to be closed by about 15 at.% U. The U–Nb gap has been studied in more detail and is closed by 14 at.% Zr. To a near approximation the ternary U–Nb gap can be considered to be bounded by the composition lines 33 at.% U, 14 at.% Zr, and about 20 at.% Nb depending on temperature. A notable feature is that at Nb and Zr compositions approximately corresponding to a line of minimum lattice distortion, the γ phase at 600°C bulges toward the U corner. As a result of the closure of the gaps the γ phase is stable over a large area of the diagram at temperatures down to at least 600°C. (auth)

6679 NYO-2742

Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.

THE DEVELOPMENT AND TESTING OF HOMOGENEOUS CERAMIC FUELS. Progress Report for Period September 1–November 30, 1959. G. Zuromsky. 24p. Contract AT(30-1)-2379, Task III. OTS.

The development and testing of dilute UO_2 ceramic fuels consisting of homogeneous solid solutions of UO_2 in ZrO_2 or in CeO_2 is presented. A suitable method for preparing phase diagram specimens by comminution-blending and cold pressing was developed for the UO_2–CeO_2 and UO_2–ZrO_2–CaO compositions. Beryllia and rhodium metal are suitable container materials for the highly reactive UO_2–CeO_2 specimens at sintering temperatures above 1400°C. Stabilized ZrO_2 is a satisfactory material for containing the UO_2–ZrO_2–CaO specimens at temperatures to 1900°C. Specimens of two UO_2–CeO_2 compositions were vacuum sintered at 1350 to 1700°C and air sintered at 1325 to 1450°C. Eight UO_2–ZrO_2–CaO compositions were vacuum sintered at 1500, 1700, and 1900°C, respectively. The UO_2–CeO_2 specimens are highly sensitive to thermal stresses and showed surface cracks on cooling from the sintering temperatures. The UO_2–ZrO_2–CaO specimens are not sensitive to similar thermal stresses. (W.L.H.)

6680 SCTM-294-59(51)

Sandia Corp., Albuquerque, N. Mex.

STUDIES OF STRAIN WAVE PROPAGATION AND ASSOCIATED CURRENT OUTPUT IN BARIUM TITANATE. J. V. Dally. Nov. 6, 1959. 46p. OTS.

The strain-versus-time pulse and the associated current output due to the impact on a barium titanate specimen by a projectile moving at about 280 feet per second is studied. A slender rod fabricated from several pieces of barium titanate ceramic B is used as the specimen. Strain and current measurements are made at three different positions along the length of the bar. It is found that charge release increases with strain level up to and probably beyond the 2-per cent strain level obtained in this study. (auth)

6681 TID-7526(Pt. 7)

Ames Lab., Ames, Iowa.

METALLURGY INFORMATION MEETING, AMES LABORATORY, IOWA STATE COLLEGE, MAY 2, 3 AND 4, 19[illegible]. Decl. Oct. 7, 1959. 18p. OTS.

The elevated-temperature mechanical properties of beryllium were enhanced by forming dispersed-phase alloys. The addition of properly dispersed BeO to beryllium in quantities of 2 to 3% is equivalent to lowering the testing temperature 200° at 1000 to 1350°F. Similarly dispersed intermetallic compounds such as $FeBe_{11}$ result in a threefold increase in strength at 1350 to 1650°F when 1.5 to 3% iron powder is blended with beryllium powder prior to fabrication. Tensile and stress-rupture properties of some of these materials are presented along with oxidation characteristics in 1650°F air, and corrosion behavior in 600°F water relative to unalloyed beryllium. (auth)

6682 WADC-TR-57-69

Brooklyn. Polytechnic Inst.

THERMAL STRESSES AND THERMAL BUCKLING. CHAPTER 1. DISTRIBUTION OF THERMAL STRESSES IN SOLID WINGS. Josef Singer. CHAPTER 2. EXPERIMENTS ON THERMAL BUCKLING OF SUPERSONIC WING PANELS. M. Anliker and S. Lederman. Apr. 1957. 11[illegible]. Project Nos. 5-(1-1347) and 6-(1-1347). Contract AF33(616)-3214. (AD-118287).

Methods for the analysis of thermal stresses in flat plates of rectangular form and of constant or variable thickness are derived, discussed, and generalized for the case of a variable thickness. Recommendations are made for the practical calculation of the thermal stresses. An experimental verification of the thermal buckling theory of the coverplates of multicellular supersonic wing structures is presented. The experiments were performed with the aid of the electromagnetic induction heater. Experimental results obtained agree well with the predictions of the theory. (auth)

6683 WADC-TR-58-275(Pt. II)

Bausch and Lomb Optical Co., Rochester, N. Y.

FABRICATION OF INFRARED TRANSMITTING MATERIALS BY HOT PRESSING TECHNIQUES. Period Covered: April 1, 1958 to March 31, 1959. Norbert J. Kreidl, Harold C. Hafner, J. Raymond Hensler, Eugene C. Letter, and Dean A. Buckner. June 2, 1959. 123p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-5123. OTS.

Studies of BaF_2 hot pressing were continued. BaF_2 compacts with good transparency in the visible and infrared were produced under pressures of 20,000 to 60,000 psi at temperatures below 900°C. Emphasis was placed on the use of higher pressures at lower temperatures in order to avoid contaminations due to high temperature reactions and

to take advantage of the use of less pure starting material. The hot pressing of polycrystalline magnesium fluoride was studied over a pressure range of 20,000 to 60,000 psi and at temperatures up to 900°C. Compacts with excellent transmission were fabricated. The anomalous absorption bands observed in the transmission of BaF_2 and MgF_2 hot pressed compacts were studied and partially elucidated. Ferric oxide, MgO, ZnO, Co_3O_4, Cu_2O, and $CoO \cdot Al_2O_3$ were the oxides studied, and in addition PbS and CdS were hot pressed. (auth)

6684 WADC-TR-59-263

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EFFECT OF HEAT TREATMENT ON THE METALLURGICAL AND MECHANICAL PROPERTIES OF 7Al–3Mo TITANIUM ALLOY. [Period covered]: September 18, 1957 to January 13, 1959. Paul L. Hendricks. May 1959. 107p. Project title: METALLIC MATERIALS. Task title: HIGH STRENGTH METALLIC MATERIALS. Contract AF33 (600)-35886. OTS.

Metallurgical and mechanical properties of 7% Al–3% Mo Ti alloy were determined on a production size heat. The investigation included heat treatment, the determination of tensile properties, stress rupture, creep stability, compressive yield, modulus, and impact strength. The testing conditions varied from room temperature up to 1900°F. (auth)

6685 WADC-TR-59-353

Crucible Steel Co. of America, Pittsburgh.

DEVELOPMENT OF HIGH-TEMPERATURE IRON-BASE ALLOYS. [Period covered] April 1958 through May 1959. A. Kasak, V. K. Chandhok, and E. J. Dulis. July 17, 1959. 69p. Project title: METALLIC MATERIALS. Task title: REFRACTOR METALS. Contract AF33(616)-5428, Phase A. OTS.

An investigation was conducted to develop steels that have very high strengths at ambient temperature and at temperatures approaching 1200°F. The results show that with proper balancing of the composition and optimum heat-treatment the objective of the program could be attained. Up to 1100°F the steels developed had higher strengths than any other steel known today. The highest strengths were obtained on steels that contained 0.35 to 0.40% C, 7 to 9% Cr, 0.5 to 1.0% V, 5 to 7% Mo, 5 to 8% Co, up to 1% Ti, up to 1% Ta + Cb, up to 1.5% W, and up to 0.01% B. One steel that contained 0.36% C, 7.72% Cr, 1.15% V, 5.71% Mo, 4.93% Co, and 0.009% B had a tensile strength of 310,000 psi at room temperature and 201,000 psi at 1100°F; the 100-hr creep-rupture strength at 1100°F was 98,000 psi. Also, excellent strengths were obtained at 1200°F. Beneficial effects on strength and ductility were sometimes derived from using a novel heat-treating schedule. Microscopic studies indicated that the fracture behavior and the creep-rupture strength were significantly influenced by the formation and coalescence of carbides at the grain boundaries. (auth)

6686 WAL-TR-132.5/1

Watertown Arsenal Lab., Mass.

A TECHNIQUE FOR THE MICROSTRUCTURAL EXAMINATION OF POLYCRYSTALLINE GRAPHITES. A. Tarpinian and G. E. Gazza. Feb. 1959. 28p. DA Project 593-32-004. (AD-210086). OTS.

The application of a metallographic technique for the microstructural study of polycrystalline graphite bodies is presented. The porous nature of these bodies presents a problem during the grinding and polishing operations which tend to break-down the pore walls, causing destruction and smearing of the original structures. To prevent this smearing, a technique for impregnating the porous structure with a resin that hardens at room temperature was used to reinforce the graphite specimens. This operation showed significant improvement in polishing efficiency and preservation of microstructure. Although some structure was visible upon microscopic examination after polishing, finer detail was brought out by etching with a solution of potassium dichromate in concentrated phosphoric acid. This etchant reacted quite readily with the graphite surface, yet at a rate that was easily controlled. A variety of photomicrographs, obtained using the techniques described, is presented and discussed. (auth)

6687 WAL-TR-325/1

Watertown Arsenal Lab., Mass.

IMPACT PROPERTIES OF MEDIUM CARBON STEELS AS AFFECTED BY BORON, RARE EARTHS, AND SELECTED ALLOYING ELEMENTS. R. E. Stiles and M. B. Pierson. June 1959. 36p. DA Project 501-01-033. (AD-216459). OTS.

Impact properties of 18 medium carbon steels, varied in composition by rare-earth additions, boron additions, and alloy modifications, were investigated. After a full martensitic quench, the steels were tempered in the range 400 through 1200°F, and tested at room temperature and –40°F. (auth)

6688 WAL-TR-830.3/1

Watertown Arsenal Lab., Mass.

THE RECRYSTALLIZATION TEMPERATURE OF IRON AS AFFECTED BY DILUTE TRANSITIONAL ELEMENTS. E. P. Abrahamson, II, and B. S. Blakeney, Jr. Jan. 1960. 15p. DA Project 5B93-32-004. OTS.

The effect of the transition elements in binary solid solution additions upon the recrystallization temperature of iron has been investigated. All these elements immediately raise the temperature, most having their major effect in less than 0.10 at.%. A correlation is noted between the rate of change of recrystallization temperature with at.% solute and the electron configuration of the added element. An explanation is proposed to account for this phenomena. (auth)

6689 AEC-tr-3961

EXPERIMENTAL DETERMINATION OF TRUE SPECIFIC HEATS OF URANIUM, THORIUM, AND OTHER METALS. E. A. Mit'kina. Translated for Los Alamos Scientific Lab. from Atomnaya Energ. 7, 163-5(1959). 5p. JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 20208.

6690 SCL-T-289

ON THE TRANSFORMATION OF WHITE TIN INTO GRAY TIN. (Über die Umwandlung von Weissem in Graues Zinn). G. Tammann and K. L. Dreyer. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. anorg. u. allgem. Chem. 199, 97-108(1931). 15p. JCL.

An investigation was made to determine the factors that influence the transformation of white tin to gray tin. The effects of heating and rolling on this transformation were also investigated. (W.L.H.)

6691

THE CRYSTAL STRUCTURE OF Zr_4Al_3. C. G. Wilson, D. K. Thomas, and F. J. Spooner (Royal Military Coll. of Science, Shrivenham, Berks, Eng.). Acta. Cryst. 13, 56-7(1960) Jan. (In English)

The crystal structure of Zr_4Al_3 was determined: a = 5.433 ± 0.002 A and c = 5.390 ± 0.002 A. The proposed space group is C_{3h}^1–$P\bar{6}$. The proposed structure bears close resemblance to the σ phase structure of the transition elements with the Zr atoms in the $\frac{1}{3}$, $\frac{2}{3}$, and $\pm\frac{1}{4}$ positions forming an unbroken chain. (C.J.G.)

6692

FAILURE MECHANISMS OF SOLID PROPELLANT ROCKET NOZZLES. Y. Baskin and T. A. Greening (Armour Research Foundation, Chicago) and M. J. Kemp (Thiokol Chemical Corp., Huntsville, Ala.). Am. Ceram. Soc. Bull. 39, 14-17(1960) Jan. 15.

Twenty-five refractory materials were evaluated as nozzle inserts in rocket motors using high-energy solid propellants. The motors, operated at various combinations of chamber pressure and burning time, yielded exhaust temperatures of about 4750°F. Although the degree of nozzle erosion varied considerably, all materials were attacked. Failure mechanisms, presented for the better-performing materials, were determined using chemical, microscopic, and x-ray-diffraction analysis. (auth)

6693

SECONDARY RECRYSTALLIZATION AND CRITICAL COLD-WORK RECRYSTALLIZATION OF HIGH-PURITY URANIUM. Nelly Ambroisis de Libanati, Daniel Calais, and Paul Lacombe (École de Mines, Paris). Compt. rend. 249, 2769-71(1959) Dec. 21. (In French)

After 150 to 400% cold-working of high-purity U, a reheat to 650°C caused a primary recrystallization followed by exaggerated growth. Cold-working of 2 to 6% applied to the primary texture caused growth of large crystals of a different texture from that of secondary crystals. These effects constitute criteria for the purity of the metal. (tr-auth)

6694

DEMONSTRATION AND INTERPRETATION OF AN INVERSION PHENOMENON IN THE DIRECTION OF DISPLACEMENT OF THE INTERFACE IN URANIUM-ZIRCONIUM DIFFUSION. Yves Adda, Claude Mairy, and Jean-Louis Andreu. Compt. rend. 249, 2775-7 (1959) Dec. 21. (In French)

The Kirkendall effect was studied in U–Zr diffusion in all regions, and an inversion effect was observed in the direction of displacement. The variations of intrinsic coefficients as a function of the concentration leads to an interpretation of this phenomenon which is confirmed by the values of the self-diffusion coefficients. (tr-auth)

6695

THERMODYNAMIC PROPERTIES OF Ni–Cr SOLID SOLUTIONS. E. Z. Vintaĭkin (Central Scientific-Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 129, 368-71(1959) Nov. 11. (In Russian)

The free-energy shift and the heat and entropy of shift in nickel-rich solid solutions of Ni–Cr alloys were studied. The pressure of saturated chromium vapor over various alloys was determined and the data corrected using data for pure chromium. The elasticity was determined for alloys containing 3.5, 7.85, 20.3, and 27.4, at. % Cr and for pure chromium at 1100 to 1300°C. (R.V.J.)

6696

ON THE SOLUBILITY OF BORON IN SILICON. V. M. Sleptsov and G. V. Samsonov (Inst. of Metalloceramics and Special Alloys, Academy of Sciences, Ukrainian SSR). Dopovidi Akad. Nauk. Ukr . R.S.R. No. 9, 982-4(1959). (In Ukrainian)

The solubility of boron in silicon was investigated by metallographic and x-ray methods. The solubility of boron in silicon was found to increase from 0.50 wt. % (1.2 at. %) at room temperature to 1.6 wt. % (2.9 at. %) at about 1300°C. The existence of a eutectic corresponding to 18 at. % of boron and a melting point of about 1370°C is shown. A hypothetical form is constructed for the section of the boron–silicon system ranging up to 40 at. % of boron. (auth)

6697

MECHANICAL PROPERTIES OF ARTIFICIAL GRAPHITE. Ph. P. Arragon (Commissariat à l'Énergie Atomique, Paris) and R. M. Berthier (Laboratoire de Recherches Scientifiques, Grenoble, France). Ind. Carbon and Graphite. Papers Conf. London, 1957, 565-78(1958).

Samples of graphite, of varying quality, were submitted to tests of simple compression, successive compression and decompression with progressively increasing maximum compression, and multiple compressions and decompressions with a constant maximum pressure. In all cases decompression of the graphite exhibits hysteresis. Above a certain limiting value of the strain a permanent deformation is found after decompression; this deformation increases with the maximum of the applied compression p. Further compressions which do not exceed the previous maximum value of p are rapidly accommodated and may be characterized by a constant paraelastic modulus which decreases linearly with p. A linear relation exists between the observed deformations under pressure p and those measured after decompression at some arbitrarily chosen pressure. The straight lines representing this relation form a converging group. The extrapolations of the lines representing the second compressions (to a first approximation) appear to converge. It appears from these two facts that the curve is an equilateral hyperbola, and that the original graphite is in a state of internal stress which could result from the methods of its production. The three principal directions of the blocks of graphite examined show a strong anisotropy of the properties considered: these also depend on the raw materials and the methods of manufacture. (auth)

6698

EFFECT OF CHEMICAL TREATMENT ON THE ELECTRICAL CONDUCTIVITY OF GRAPHITE. R. Bhattacharyya (Indian Assn. for the Cultivation of Science, Calcutta). Indian J. Phys. 33, 407-9(1959) Sept.

Recently it was shown that the usual purificatory treatments of naturally occurring crystals of graphite caused an easily detectable enhancement of the small amount of misalignment originally present between the basal planes of the different crystal blocks. Results are included for the electrical conductivity of three samples of Ceylon graphite. The measurements were made both parallel and perpendicular to the basal plane. The conductivities perpendicular to the c-axis were found to be much greater than those parallel to the c-axis. A large number of theoretical attempts were recently made to obtain a reasonable electronic picture of graphite based on experimental results. (B.O.G.)

6699

THE ADHESION OF ELECTRODEPOSITED NICKEL TO CHROMIUM AT ELEVATED TEMPERATURES. Walter I. Reid, Jr. and Fielding Ogburn (National Bureau of Standards, Washington, D. C.). J. Electrochem. Soc. 107, 91-3 (1960) Feb.

The use of a composite coating of electrodeposited nickel and chromium to protect molybdenum from oxidation at 800 to 1200°C exhibited certain practical limitations. Examination of the composite coating showed that the problems of blister formation, weakening of the bond between nickel and chromium, and edge separation were interrelated. Blister formation was eliminated and edge separation reduced slightly by an improved treatment of the chromium surface prior to nickel plating. The weak-

ening of the bond between nickel and chromium appears to be inherent in the coating system. (auth)

6700

ALUMINIUM ALLOYS FOR WATER-COOLED POWER REACTORS. E. C. W. Perryman (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Inst. Metals 88, 62-73(1959) Oct.

The corrosion properties of aluminum–nickel–iron alloys in both static and dynamic high-temperature water are described. It is shown that the corrosion-resistance in high-temperature water flowing at 20 ft/sec is about eight times that in a static system, and that there is little effect of alloy composition under dynamic conditions. Under flowing conditions, the corrosion rate is shown to be very dependent on the amount of aluminum surface within the dynamic system, and this is thought to be due to saturating the water with aluminum oxide. Under dynamic conditions, the lowest corrosion rate observed is about 8×10^{-3} in./year, but an oxide film formed on samples in static water will reduce the corrosion rate to about 2×10^{-3} in./year. The effect of inhibitors is discussed, and also that of heat flux. Results are given for both short- and long-term mechanical properties. The properties of these alloys are discussed in relation to water-cooled power reactors, and it is shown that at the present stage of development they are not competitive with zirconium alloys for fuel sheathing. (auth)

6701

A NOTE ON THE URANIUM–BORON ALLOY SYSTEM. B. W. Howlett (Massachusetts Inst. of Tech., Cambridge). J. Inst. Metals 88, 91-2(1959) Oct.

A study was made of the uranium–boron system by x-ray, metallographic, and dilatometric techniques. The solid solubility of boron in uranium is low. UB_2, melting at 2385°C, forms a eutectic with uranium at 2 to 3 at. wt. % boron. A constitutional diagram is presented. (auth)

6702

THE EFFECT OF HYDROGEN IN QUANTITIES OF UP TO 0.009% ON THE ROOM-TEMPERATURE IZOD AND TENSILE STRENGTH OF COMMERCIALLY PURE TITANIUM. R. H. Beton (Imperial Chemical Industries, Ltd., Birmingham, Eng.). J. Inst. Metals 88, 93-5(1959) Oct.

Tests on slowly cooled bars of titanium indicated that the Izod strength progressively increased as the hydrogen content was reduced from 0.009 to 0.001%. Hydrogen and oxygen atoms had approximately equivalent deleterious effects on the impact strength of titanium. The tensile strength increased when the straining rate was changed from the slowest to the fastest available; this increase was independent of the hydrogen content and also of the cooling rate. (auth)

6703

THE FABRICATION AND PROPERTIES OF RUTHENIUM. D. W. Rhys (Mond Nickel Co., Ltd., London). J. Less-Common Metals 1, 269-91(1959) Aug. (In English)

Sintered powder compacts were the best starting material for the fabrication of strip and rod, but purity, powder preparation, and sintering conditions required careful control if satisfactory products were to be obtained. Control of these variables was followed by hardness, density, and metallographic examination. Ruthenium developed directional properties during working and these were not removed by annealing. Single crystal ruthenium prepared by floating zone electron bombardment melting had good initial ductility but work hardened very rapidly; annealing of worked single crystals produced brittle polycrystalline material. During zone refining of ruthenium major purification occurred by evaporation. The properties of ruthenium with particular reference to its ductility and possible applications are discussed. (auth)

6704

THE COMPOUND Bi_4Rh. R. G. Ross and W. Hume-Rothery (University Museum, Oxford). J. Less-Common Metals 1, 304-8(1959) Aug. (In English)

It has been suggested that the compound Bi_4Rh existed in three modifications with transformation temperatures α/β 310°C and β/γ 390°C. Diffraction films taken in a high temperature x-ray camera show that only one structure exists between room temperature and 460°C, the temperature of the $Bi_4Rh \rightleftharpoons Bi_2Rh$ + Liq. peritectic horizontal. The crystal structure of this one modification is body-centred cubic, space group No. 230, lattice parameter 14.9274 ± 0.0002 A at 20°C, and is identical with the α-Bi_4Rh modification of previous investigators. The liquidus curve of Bi-rich BiRh alloys was redetermined and the most probable equilibrium diagram is reproduced. (auth)

6705

A NOTE ON TRANSFORMATIONS IN METALLIC CERIUM. R. T. Weiner and G. V. Raynor (Univ. of Birmingham, Eng.). J. Less-Common Metals 1, 309-13(1959) Aug. (In English)

Experiments on two samples of metallic cerium, respectively 99 and 99.95% pure, have failed to produce transformation from the normal face-centred cubic structure (α_0 = 5.1502 A) to the close-packed hexagonal modification to which references appear in the literature. A possible new phase has, however, been observed after annealing the normal face-centered cubic modification for periods of 24 hours to one week at temperatures above 500°C, followed by slow cooling. The new structure, which is face-centered cubic, has a lattice spacing α_0 = 5.112 A, and after annealing at 700°C, is admixed with only very small amounts of the initial face-centered cubic structure with α_0 = 5.1502 A. The latter may possibly be metastable at room temperature in samples solidified from the melt. The new structure may be connected with the presence of small amounts of hydrogen in the samples, as evidenced by the detection in diffraction patterns of very weak lines due to CeH_2. (auth)

6706

SOME OBSERVATIONS ON THORIUM-RICH THORIUM–INDIUM ALLOYS. J. R. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Less-Common Metals 1, 314-20(1959) Aug. (In English)

Thorium–indium alloys containing 0 to 33 at. % indium were studied by metallographic and x-ray methods. Within this composition range one compound, Th_2In, occurs; this melts at 1170 ± 10°C and forms a eutectic with α-thorium at approximately 18 at. % indium and 1160 ± 10°C. Th_2In has the tetragonal $CuAl_2$(C16) structure, a = 7.787, c = 6.113 A, and is isostructural with Th_2Al, Th_2Ag, etc. The solubilities of indium in α-thorium at 1160 and 800°C are approximately 9.2 at. % and 1.7 at. %, respectively; solubility of indium increases the room temperature hardness of thorium and age-hardening was observed at 600°C in an 8.6 at. % indium alloy. Within the solid solubility range, indium enhances the oxidation resistance of thorium at room temperature but the intermetallic compounds oxidize readily to form indium and thorium oxide. (auth)

6707

SEEBECK COEFFICIENT OF YTTRIUM FROM 0° TO

1000°C. H. A. Johansen and R. C. Miller (Westinghouse Research Labs., Pittsburgh). J. Less-Common Metals 1, 331-2(1959) Aug. (In English)

The specimen was swaged from material with an yttrium analysis of 99.7% to a rod 1/16 in. in diameter and 16 in. long. The cold junction of the Pt–Pt 10% Rh couple and the Y-rod were immersed in a bath to maintain a constant temperature. The hot junction was maintained in a flow of argon purified by passing over heated zirconium turnings. The hot junction equilibrium was checked by reading Y–Pt, Pt–PtRh, and PtRh–Y emf's in quick succession. The Seebeck coefficient and the thermal emf of yttrium was differentiated in the range of 0 to 1000°C. (B.O.G.)

6708

A BALANCED ISOPIESTIC APPARATUS. APPLICATION TO $CeCd_{\sim 6}$ SOLID SOLUTION SYSTEMS. Guy R. B. Elliott and Joe F. Lemons (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 64, 137-45(1960) Jan.

An apparatus is described for determining the vapor pressure of a volatile component in solution in non-volatile components over a range of compositions and temperatures. By coupling an analytical balance with an isopiestic equilibrator operating in a temperature gradient and suspended in a freely pivoting position, it is possible to measure the solution composition and deduce the vapor pressure of the volatile component from a knowledge of the vapor pressure of the pure component as a function of temperature. By changing the temperature in small increments it is possible also to change solution compositions in small increments and to measure the variation of thermodynamic activity with these very small changes of composition. The vapor pressure is reported for cadmium over solid solutions of cerium and cadmium of various compositions in the region $CeCd_{\sim 6}$ at 847 and 912°K. At 847°K measurements of eight compositions between the phase region limits of approximately $CeCd_{6.098}$ and $CeCd_{5.967}$ show that the cadmium vapor pressure changes gradually with composition across the phase. At 912°K the phase limits are approximately $CeCd_{6.118}$ and $CeCd_{5.971}$; measurements at nineteen compositions within this range show a trend in cadmium vapor pressure similar to that observed at 847°K. Uncertainty in assignment of exact compositions rests principally on starting material impurities rather than on uncertainties of the method. Some possible models to explain the change in cadmium activity with composition in solid $CeCd_{\sim 6}$ are discussed. A very good fit to the experimental data is achieved with a model which assumes perfect solution in a $CeCd_6$ lattice of cadmium atoms in defect sites and of cadmium atoms surrounding cerium holes. Heats and entropies of reactions between standard states representing species within the phase are calculated. As operated, the balance readily detected a shift of one part in three million of the suspended weight. (auth)

6709

THE INTERNAL DAMPING OF CHROMIUM STEELS. Josef Vodsedálek (Výzkumný Ústav Materiálu a Technologie, Prague). Materiálový Sborník, 5-26(1956). (In Czech.)

Definitions are given of the internal damping of materials, its causes are discussed and the factors which influence damping are determined. The magneto-mechanical component of damping is emphasized since it plays a principal part with chromium steels at the usual cyclic tensions. The damping properties of chromium steels indicate the influence of deviations in the chemical constitution and the influence of heat treatment, testing temperatures, and magnetic fields. Attention is given to the influence of static prestressing which is able to totally change the damping character by suppressing the magneto-mechanical component. Advantageous conditions for the thermal treatment of Cr-steels with respect to damping and fatigue are also stated. (auth)

6710

CREEP BEHAVIOUR OF AUSTENITIC STEELS. Milos Vystyd. Materiálový Sborník, 7-21(1958). (In Czech.)

A survey of austenitic steels used for high pressure and high temperature steam power plants is given. The relations existing between the theory of creep and the practical development of new steels or alloys are discussed. The influence of chemical composition, heat treatment and notch toughness upon the creep resistance of austenitic steels is investigated. Results of creep tests made with Czechoslovak austenitic steels are presented and compared with those of foreign steels. (auth)

6711

RELAXATION BEHAVIOUR OF MnCrTi (CSN 17481), AKVSb (CSN N7341) AND AKVS (CSN17246) AUSTENITIC HEAT RESISTANT STEELS. Radovan Pech. Materiálový Sborník, 23-31(1958). (In Czech.)

Appropriate values were determined for the dimensioning of screw bolts made from MnCrTi Poldi AKVSB and Poldi AKVS steels, designed to work at temperatures up to 600°C. The investigation concerned the influence of various factors, as heat treatment, cold working, and repeated stress, upon the relaxation resistance of AKVS steels. To facilitate the function of austenitic screw-bolts annealing during heat treatment should be done at as high as possible a temperature within the range of 1050 to 1150°C. Before mounting the bolts they should be submitted to a twenty hours pre-relaxation, using a device specially provided for the purpose. When tightening the bolts, use a torque indicating wrench or a similar device to prevent the bolts from being plastically deformed. (auth)

6712

VIBRATION DAMPING PROPERTIES OF AUSTENITIC STEELS AND HEAT RESISTING ALLOYS. Josef Vodsedálek. Materiálový Sborník, 33-50(1958). (In Czech.)

Results from the study of vibration damping procedures of austenitic steels and of heat resisting alloys aged at room temperature indicate that the damping of these materials is mainly due to the plastic damping component. The characteristic properties of austenitic steels, i.e., the increase of damping at increasing alternating and static stresses and the typical dependence of the steels on their history of stresses and on temperature, manifest themselves in different ways at under- and over-critical temperatures. The critical temperature depends on the type of atoms that form the "atmosphere" of dislocation. With progressive fatigue, damping becomes essentially reduced, a circumstance which proves very dangerous in the case of impellers (particularly of gas turbine impellers). For a number of steels and for some austenitic alloys capable of aging, the law according to which damping decreases due to fatigue at higher temperatures was determined. The investigations were made at continuous as well as interrupted operation and the laws derived hold true from a general point of view. (auth)

6713

ON THE POSSIBILITY OF JUDGING THE SUITABILITY

OF HEAT-RESISTANT MATERIALS BY MEANS OF HOT HARDNESS TESTS. Eduard Jelínek. Materiálový Sborník, 51-66(1958). (In Czech.)

The relations between hardness and short-duration hot strength of heat resistant materials are discussed. The results of investigations into relations between hardness and the creep behavior of materials at high temperatures are given. Data concerning change of hardness with temperature of certain steels and alloys of Czechoslovak make were determined up to temperatures of 800°C. Standard tensile tests within the same temperature range yielded the short-time hot strength required for comparison. In the comparison of hot hardness tests with creep properties, Larson-Miller diagrams were used for comparison. Certain correlations of qualitative character was found to exist between these properties. From results it is concluded that the determination of hot hardness can serve as an inexpensive and ready method for obtaining qualitative indications about the suitability of materials for work at high temperatures. (auth)

6714

RECRYSTALLIZATION AND INTERMEDIATE THERMAL TREATMENT OF LOW-CARBON STEELS DURING COLD WORKING. Vladimír Vrzal. Materiálový Sborník, 55-78 (1956). (In Czech.)

The problem of the intermediate thermal treatment of cold worked low-carbon steels is discussed. From a general analysis of the physical processes going on within the steel during working and from experimentally determined spatial diagrams of hardness variation and grain growth during annealing (depending upon temperatures and reductions) the intermediate thermal treatment by which a sufficient renewal of the ductility of the worked steel is obtained without causing too high a grain growth in the critically worked regions was determined for two steels. For the two steels, one having nominally 0.06%, the other 0.15% of carbon, the critical degrees of working transformation were found to be 12 to 15% and 11% respectively. For the first steel, the temperature of intermediate annealing was found to be 575 to 600°C and for the second one 560 to 615°C, the annealing time being 30 minutes. The influence of this annealing process was studied by means of isothermal cuts through the spatial diagrams of hardness variation. The renewal of the workability occurs in the critically worked parts. A complete homogenization after cold working can only be reached by normalizing. (auth)

6715

CONTRIBUTION TO THE INVESTIGATION OF THE QUALITIES OF HEAT RESISTING IRON–ALUMINIUM ALLOYS. Jaroslav Pluhař (Výzkumný Ústav Materiálu a Technologie, Prague). Materiálový Sborník, 97-115(1956). (In Czech.)

The mechanical, physical, and chemical properties of a carbidic iron-aluminum alloy, Pyroferal, are reported. Its bearing power at high temperatures, and the weldability and the heat resistance of welds are treated in detail. Reference is made to the tendency of decomposition of some of these alloys and conditions are indicated to prevent this phenomenon. The properties of Pyroferal are compared with those heat resistant alloys of the chromium and chrome-nickel type. (auth)

6716

OPERATING RESULTS OF THE NEW ECONOMICAL AND HEAT RESISTING ALLOY Fe–Al TYPE PYROFERAL AND PROPOSITIONS FOR ITS APPLICATION. Miloslav Vyklický. Materiálový Sborník, 141-55(1956). (In Czech.)

A survey was made of operating tests on machine parts cast from Pyroferal, such as; blades for pyrite furnaces, crucibles for cementation, for aluminium, borax and bronze, and grate bars for steam boilers. Thoroughly tried and well proved with respect to long life are Pyroferal blades for pyrite furnaces, crucibles for cementation, and crucibles for aluminium. Operating results obtained by testing Pyroferal specimens placed in natural gas cracking installations and in caustic soda are given. Based on laboratory and operating tests, a discussion is given on the future application of Pyroferal to various machine parts. (auth)

6717

THE INFLUENCE OF STRUCTURE UPON SOME PROPERTIES OF HIGH-SPEED STEELS. Josef Vobořil, Jaroslav Ježek, and Jiří Průcha (Státní Výzkumný Ústav Materiálu a Technologie, Prague). Materiálový Sborník, 193-216(1958). (In Czech.)

The structure and properties of 18-4-1-(W-G-V), 9-4-2-, and 11-4-4- high-speed steels were studied to eliminate certain difficulties which arise during production and application of tools made from these steels. A statistical survey of the most frequent defects is given. Extended thermal treatment tests and detailed metallographic studies are described. The results of a study on the structure and growth of the primary grain at the formation of austenite as a function of time and temperature are given. To study precipitation phenomena, x-ray structure analyses of the separated carbides were made and investigations by electron microscopy carried out with the aid of simple extraction replicas. The results show that, contrary to Kuo's assumption, the second hardness is not caused by the precipitation of W_2C carbides but by the joint action of two phenomena: the decay of residual austenite and the separation of the fibrous precipitate of VC carbide. As the carbide W_2C appears in this isolate prior to the existence of a maximum hardness, it cannot be the cause of a second hardness. The relation between structure and final mechanical properties of the high-speed steels is discussed. (auth)

6718

SELF DIFFUSION IN LIQUID In–Pb ALLOYS. A. Paoletti (Comitato Nazionale per le Ricerche Nucleari, Rome) and M. Vicentini (Università, Rome). Nuovo cimento (10) 14, 748-57(1959) Nov. 16. (In English)

The self-diffusion coefficient in the liquid alloys In–0.5% Pb and In–1.5% Pb was measured over a wide range of temperatures, using In^{114} and RaD as tracers. The results show, within the experimental errors, the independence of the activation energy of the tracer. This fact was interpreted as an indication of a long range contribution of the atoms to the energy barrier for the diffusion. (auth)

6719

THERMOELECTRIC POWER OF COLD-ROLLED PURE COPPER. R. H. Kropschot and F. J. Blatt (Michigan State Univ., East Lansing). Phys. Rev. 116, 617-20(1959) Nov. 1.

The difference between the thermoelectric power of severely cold-rolled and well annealed pure copper was measured between 8 and 320°K. The absolute thermoelectric power of our annealed and cold-worked samples was determined over the same temperature range by measuring the thermoelectric power of a thermocouple formed from annealed pure copper and pure lead. The thermoelectric power of cold-rolled copper is positive relative to annealed pure copper over the entire temperature range, and the effect of cold work is largest at very low temperatures where the thermoelectric

power of annealed copper displays a pronounced minimum. These results are in fair agreement with recent work by Powell and by van Ooijen. (auth)

6720

OBSERVATIONS ON RHENIUM–TUNGSTEN ALLOYS. K. Kirner (Union Carbide Corp., Indianapolis). Planseeber. Pulvermet. 7, 117-19(1959) Dec. (In German)

Re-W alloys were arc melted between tungsten electrodes, checked metallographically and their hardness was determined. Two intermetallic phases were found, one of which—a sigma phase—having a broad homogeneity range (approximately from 40 to 60%) and a high hardness (1800 VPN_{300}). (auth)

6721

CARBIDES OF ELEMENTS OF THE FIFTH GROUP OF THE PERIODIC TABLE BONDED WITH STEEL. M. Epner and E. Gregory (Sintercast Corp. of America, Yonkers, N. Y.). Planseeber. Pulvermet. 7, 120-28(1959) Dec. (In English)

A preliminary investigation of some of the properties of vanadium, tantalum, and niobium carbides bonded with carbon steel was carried out. The results are compared with the properties of titanium carbide bonded with a similar steel. All compositions responded to heat treatment and were machinable in the annealed condition but each cermet had individual characteristics which are attributed, in part, to differences in the physical and mechanical properties of the various carbides. (auth)

6722

ELECTROKINETIC EFFECTS IN LIQUID METALS. G. E. Pikus and V. B. Fiks (Semiconductor Inst., Academy of Sciences, Leningrad). Soviet Phys.–Solid State 1, 972-80(1960) Jan.

The theory of electrokinetic effects in liquid metals is developed. These effects are caused by inelastic scattering of current carriers at the metal boundaries and lead to the creation of a transfer flow when an electric current is passed through liquid metal contained in a thin capillary, and to the creation of a transfer current when the liquid flows through the capillary. Using Onsager's relationships, formulas were obtained for the transfer current and transfer potential. (auth)

6723

ELECTROKINETIC EFFECTS AND THE VISCOSITY OF ELECTRONS IN LIQUID METALS. II. V. B. Fiks and G. E. Pikus (Inst. of Semiconductors, Academy of Sciences, Leningrad). Soviet Phys.–Solid State 1, 1049-59 (1960) Jan.

A kinetic theory of the transfer current, formed when liquid metal flows through a capillary, is developed. It is shown that the transfer current, formed in the volume because of a nonhomogeneous distribution of velocities, results in an increase in the viscosity of electrons. The total transfer current and its distribution over the cross section of the capillary are calculated. (auth)

6724

CONDUCTIVITY MEASUREMENTS IN THE ZrO_2–MgO SYSTEM. E. Kauer, O. E. Klinger, and A. Rabenau (Allgemeine Deutsche Philips Industrie GmbH., Aachen). Z. Elektrochem. 63, 927-36(1959). (In German)

The electric conductivity of pure ZrO_2 and ZrO_2–MgO was measured as a function of temperature in the range from 500 to 1500°C. Thermoelectric force measurements were also carried out which indicated in both cases positive charge carriers. The measurement results confirm that the conductivity, at least at the oxygen partial pressure of air, is produced pre-eminently by oxygen vacancies. It was shown that with knowledge of the conduction mechanism, the pattern of the conductivity with respect to temperature and time can be used as a sensitive method for following the solid body reactions occurring. The pattern gives not only information on the phase ratios, but permits an insight into the time course of the transformations. (tr-auth)

6725

CONSTITUTION OF ZIRCONIUM–PALLADIUM ALLOYS. Kurt Anderko (Metallgesellschaft AG., Frankfurt am Main). Z. Metallk. 50, 681-6(1959) Dec. (In German)

Small additions of palladium increase the corrosion resistance of arc-melted sponge zirconium in pressurized water and steam. The phase diagram of the zirconium–palladium system was established in the range 0 to 50 at. % Pd by means of thermal, microscopic, resistometric, and roentgenographic analysis and was investigated in a cursory manner in the range 50 to 100 at. % Pd. The following intermediate phases were observed: Zr_2Pd, ZrPd, $ZrPd_2$, and $ZrPd_3$. The solubility of palladium in α-zirconium lies below 0.1 at. %, that in β-zirconium amounts to 11.5 at. %. The metastable ω phase occurs as a transition phase in the decomposition of the β-Zr phase. (auth)

6726

METAL FATIGUE. J. A. Pope, ed. London, Chapman and Hall, Ltd., 1959. 391p.

The theory of fatigue fracture is discussed. Criteria of failure in metals under both static and oscillating stress are given and the effects of residual stresses and cumulative damage fatigue are described. Stress concentration factors are defined and the effect of stress cycle, notch shape, specimen size, and material on the various factors is discussed. The effects of corrosion fatigue and fretting corrosion are described. Crack propagation and the temperature effect on fatigue properties in steel are discussed. The fatigue properties of aluminum alloys, cast iron, high-temperature alloys, welds, joints, brasses, bronzes, and bearing metals are given. The effects of fatigue load on aircraft structure are described. Fatigue testing of bearings, welded structures, and aircraft structures is discussed. The reproducibility of fatigue testing results and the statistics applied to fatigue testing are discussed. (C.J.G.)

Radiation Effects

6727 AERE-R-3114

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE OXIDATION AND CORROSION OF ZIRCONIUM AND ITS ALLOYS. VIII. THE EFFECT OF NEUTRON IRRADIATION ON THE DISSOLUTION RATE OF ZrO_2. K. Alcock and B. Cox. Oct. 1959. 8p. BIR.

The dissolution rates of irradiated and unirradiated samples of ZrO_2 were measured. The results show that there is no significant increase in the over-all rate of dissolution of ZrO_2 following a fast neutron dose of 5.5×10^{19} nvt. It appears that the first 15% of each irradiated zirconia sample dissolves more rapidly; however, it was not shown conclusively that this accelerated rate is due to displaced atoms. A change in specific surface area resulting from the irradiation is the probable cause. (J.R.D.)

6728 FZM-1722

Convair, Fort Worth, Tex.

TRANSIENT IRRADIATION RESPONSE OF SEMICONDUCTORS. A. B. Spears. Jan. 12, 1959. 14p.

Presented at the Winter Meeting of the American Nuclear Society, Detroit, Michigan, December 8–10, 1958.

A number of semiconductor components were irradiated in a series of eight prompt critical bursts. The results show transient increases in output signal as much as 60% and permanent or semi-permanent decreases to 50%, within the 500 μsec time interval included by the photographs. Photographs are contained which show the dynamic output response of a component. (C.J.G.)

6729 HW-61656

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE IRRADIATION OF THIN EVAPORATED FILMS OF URANIUM DIOXIDE. Interim Report. T. K. Bierlein and B. Mastel. Sept. 9, 1959. 17p. Contract AT(45-1)-1350. OTS.

Electron microscopy of evaporated films of uranium dioxide, irradiated at a temperature below 60°C to an exposure of 2.3×10^{16} nvt, thermal, (2.38×10^{15} fissions/cc; 1.6×10^{-3} at.% depletion of U^{235}; or 3.8×10^{-6} at.% burnup of all atoms), discloses the presence of fission fragment trajectories with diameters of 150 A. Each of the continuous trajectories observed corresponds to a fission event in the film. Irradiation of the film to higher exposures obliterates the fission trajectories and for exposures of 4×10^{19} nvt the original homogeneous film has reverted to a heterogeneous film from which isolated flocculent growths of uranium dioxide emanate. The relative intensities of the various lines which comprise the electron diffraction pattern of the thin uranium dioxide films change during irradiation. After an exposure to 8.4×10^{18} nvt a new, unidentified line with an interplanar spacing of 3.43 A appears. After an exposure to 2×10^{19} nvt all the sharp diffraction lines disappear and only two extremely broad diffraction bands persist; sharp diffraction lines again develop during further irradiation exposure to 4.4×10^{19} nvt. Interplanar spacings for the thin evaporated films appear to have a maximum value after an exposure of 4×10^{17} nvt. (auth)

6730 USNRDL-TR-371

Naval Radiological Defense Lab., San Francisco.

SPECIFIC IONIZATION MEASUREMENTS AND ENERGY REQUIREMENTS FOR F-CENTER FORMATION. R. D. Jordan and R. S. Alger. Sept. 16, 1959. 22p.

Absolute and relative measurements were made of the energy required to produce F centers in pure and sensitized alkali halide crystals by bombardment with electrons and deuterons accelerated in a Van de Graaff generator. In KBr + KH exposed to 1.2-Mev electrons, 35 ev were required per F center. This value is in agreement with other published data. A value of approximately 100 ev was required with deuterons and KBr + KH. Slightly lower yields were found for several other salts. The specific ionizations of electrons, deuterons, and gamma rays were investigated and used to determine the accelerator beam size and penetration. The ranges of electrons in KBr, KCl, and NaCl were measured as a function of accelerator voltage and found to agree well with ranges predicted by the Feather rule. Energy transport and features of the specific ionization pattern are discussed in terms of the Seitz synthesis of crystal imperfections. (auth)

6731 NAA-SR-Memo-4596

STATISTICAL DATA ABOUT THE BEHAVIOR OF FUEL PROVIDED FOR THE USE OF THE EL_3 REACTOR. J. A. Stohr. Translated by K. Langrod and F. R. Bennett (Atomics International Div., North American Aviation, Inc.) from a paper presented at the Symposium on the Metallurgy of Nuclear Materials, Stockholm, October 1959. 22p. JCL.

Capsules containing samples of U–1.5 Nb–4.5 Zr, U–10 Mo, U–2 Mo, U–3 Mo, and U–1.5 Mo alloys were irradiated in the EL_3 reactor. The capsules were examined periodically after each increment of 400 Mwd/t. The periodic radiographic examinations conducted on the samples did not reveal any deformation of the alloy slugs, or any loosening of the cladding even under the highest burnups. (W.L.H.)

6732

RADIATION-RESISTANT GREASES. AN INVESTIGATION INTO REACTOR LUBRICATION PROBLEMS. N. A. Scarlett and J. O. Cliffe (Shell Research Ltd., [Thornton Research Centre, Chester, Ches., Eng.]). Nuclear Eng. 5, 23-6(1960) Jan.

The performance of some greases was tested under reactor conditions. The tests included examination under the combined effects of radiation and high temperature in a CO_2 atmosphere. In-pile bearing tests indicate greases will operate satisfactorily at elevated temperatures in a CO_2 atmosphere to a dosage of 2.7×10^{18} n/cm^2. A greatly extended grease life was obtained by using conventional end covers, which shielded the bearing against windage. The use of thin metal shields resulted in reduced life, while with totally unshielded bearings, the life was only 2% of that obtained with conventional end covers. (B.O.G.)

6733

FUNDAMENTALS OF THE PHYSICAL RADIATION EFFECT ON SOLID BODIES. Rudolf Sizmann (Technische Hochschule, Munich). Nukleonik 1, 357-68(1959) Dec. (In German)

A summary is made of the present knowledge on the effects of radiation on solids. Consideration is given to primary effects, calculation of the number of Frenkel defects, displacement, displacement energy, ionization range, formation of foreign atoms, perturbation range, collision chain in crystal lattice, and reformation of lattice defects. 73 references. (J.S.R.)

6734

IONIZATION EFFECTS PRODUCED IN DIAMONDS SUBJECTED TO MONO-ENERGETIC β-RAY BOMBARDMENT. P. J. Kennedy (Wheatstone Lab., King's Coll., London). Proc. Roy. Soc. (London), A 253, 37-51(1959) Nov. 17.

The ionization produced within diamond specimens by the passage of high-energy β rays was investigated using the methods of conduction pulse counting, and a new technique was developed to enable pulse-height spectra to be taken, rapidly and in quick succession, under widely different experimental conditions. It is shown that only a small proportion of the incident β rays may dissipate their total energy within the specimen and that pulse-height spectra can be interpreted successfully only when a conduction pulse is related to the energy lost by the electron producing it. Under conditions of saturation field strength and low crystal polarization, the conduction pulse magnitude is proportional to the energy dissipated. The mean value of energy per ion pair is thus independent of the primary electron energy and the experimental value of 20 ev is shown to be remarkably consistent between diamond specimens. This value differs from the previously accepted value of 10 ev and, if used in preference to 10 ev, removes many apparent anomalies from previously published work. A theory is outlined in which it is proposed

that the degradation of the primary electron energy takes place principally by interaction with the valence electrons of the crystal. The mean energy per ion pair depends, not only on the width of the forbidden gap in the solid, as previously suggested, but also on the width of the valence band and particularly on the position of the maximum in the density of states curve within the valence band. The available data for diamond suggest a value of approximately 18 ev for the mean ionization energy. This value is consistent with the experimental value from the maximum pulse height under saturation conditions. The finite breadth of the pulse spectra, can be explained only by some charge-reducing process occurring after the total dissipation of the incident energy. The process is tentatively linked with the scintillation response of the diamond crystal. Criteria are suggested by which the conduction pulse response of various solids may be predicted. (auth)

6735

RADIATION-INDUCED CHANGES IN THE STRUCTURE OF POLYPROPYLENE. R. M. Black and B. J. Lyons (British Insulated Callender's Cables Ltd., [London]). Proc. Roy. Soc. (London), A 253, 322-30(1959) Dec. 15.

Polypropylene undergoes both cross-linking and random main-chain fracture when exposed to high-energy radiation, the ratio of cross-linking to chain fracture varying with the dose received up to the gel point. An examination of the infrared absorption spectrum of the irradiated polymer has shown that, in addition, vinylidine unsaturation ($R.R'C=CH_2$) is formed in the ratio of one vinylidene double bond to each chain fracture. The rate of main-chain fracture deduced from intrinsic viscosity measurements was found to be initially (up to a dose of 35 Mrad) a function of the number of chain fractures produced, rather than proportional to the intensity of the radiation, expected from the behavior of other polymers. After a dose of 50 to 60 Mrad an insoluble cross-linked gel can be separated from the polymer by solvent extraction, and the sol fraction decreases on further irradiation in accordance with the theoretical expression derived by Charlesby (1953), assuming that for every cross-link formed, one bond between two monomer units is broken. A mechanism for the radiation-induced changes is proposed, based upon the application of classical chemical kinetics, which is in good agreement with the observed phenomena. (auth)

6736

ON THE ELASTIC PROPERTIES OF NEUTRON IRRADIATED QUARTZ. G. S. Zhdanov, V. G. Zubov, A. T. Ivanov, and M. M. Firsova (Lomonosov Moscow State Univ.). Soviet Phys.–Cryst. 3, 726-30(1960) Jan.

The elastic constants, c_{ij}, of α-quartz irradiated by fast neutrons in a reactor were measured by the method of Bergman and Schaeffer. After irradiation with 2×10^{19} neutrons per cm^2, changes were observed in the elastic constants which exceeded the experimental error and ranged from 0.9 to 1.7%, as well as a decrease in density amounting to 0.18%. The thermal variations in the elastic constants of quartz and the variations due to irradiation corresponding to the same change in density are quite different. Qualitatively the results agree with Mayer and Gigon's measurements of the elastic moduli, s_{ij}, of neutron irradiated quartz. (auth)

6737

METHOD OF LUBRICATING EQUIPMENT SUBJECTED TO IONISING RADIATION. John Owen Cliffe. (to Shell Research Ltd.). British Patent 819,023. Aug. 26, 1959.

A radiation-stable lubricant is offered which consists of an inorganic-gelled mineral oil of viscosity-gravity constant 0.85. In one example 20 kg of silica gel in isopropyl alcohol was washed with a petroleum fraction (b.p. 65 to 95°C) until the isopropyl alcohol was below 1 wt.%. This "benzogel" was water proofed by refluxing with 2.5 times as much dimethyldichlorosilane until 98% of the silane was consumed. This was stirred into a lubricating oil of viscosity 117 cs at 100°F until silica concentration was 4.5%. After volatile hydrocarbons and unreacted silane were stripped, a grease with half-scale worked penetration of 159 resulted. After 0.5×10^{18} neutrons/cm^2 irradiation the value was 164 and at 1.3×10^{18} neutrons/cm^2 it was 159. Other examples of this type of lubricant are given. (T.R.H.)

PHYSICS

General and Miscellaneous

6738 AECU-4604

Pennsylvania. Univ., Philadelphia.

PUBLICATIONS FOR 1959. Contract AT(30-1)-2202. 116p. OTS.

Five papers are presented on potential scattering, spin-orbit coupling between nucleons, and photodisintegration of the deuteron. Separate abstracts have been prepared for each paper. (W.D.M.)

6739 AECU-4604(Paper 1)

Pennsylvania. Univ., Philadelphia.

A NOVEL DISPERSION RELATION FOR POTENTIAL SCATTERING. Abraham Klein and Benjamin W. Lee. 32p.

A dispersion relation for potential scattering is found which holds without restriction on momentum transfer. The price paid for this achievement is that the integral in the relation involves a completely non-physical amplitude. Nevertheless it is shown that in combination with the unitarity condition, the Born series, in the event it converges, is completely determined. The transition to the more customary relation is also carried through. (auth)

6740 AECU-4604(Paper 2)

Pennsylvania. Univ., Philadelphia.

MESON-THEORETICAL CALCULATION OF THE SPIN-ORBIT COUPLING BETWEEN TWO NUCLEONS. A[braham] Klein, N. Tzoar, and R. Raphael. 15p.

A meson-theoretical calculation of the spin-orbit coupling between two nucleons is presented. The basic idea of the approach was used previously by Miyazawa and McCormick and Klein. Results are compared with the calculations of Okubo and Sato. (W.D.M.)

6741 AECU-4604(Paper 3)

Pennsylvania. Univ., Philadelphia.

THEORY OF THE PHOTODISINTEGRATION OF THE DEUTERON. Abraham Klein and J. Donald Pearlstein. 17p.

Both the existing experimental information and previous theoretical considerations suggest that it is convenient to divide the analysis of the photodisintegration of the deuteron into two energy regions. In one, roughly speaking, the region below 100 Mev, it now appears that the experimental results can be understood completely within the framework of conventional quantum mechanics. In the high energy region, however, there is clear evidence for the presence of virtual meson currents which become predominant with increasing photon energy. The work to be described represents an attempt, based on the formalism of field theory, to justify from first principles the conventional treatment of the lower energy region and to provide a qualitatively satisfactory account of both the total cross-section and angular distributions in the high energy region. (auth)

6742 AECU-4604(Paper 4)
Pennsylvania. Univ., Philadelphia.
MANDELSTAM REPRESENTATION FOR POTENTIAL SCATTERING. Abraham Klein. 29p.

A proof of the Mandelstam representation for the non-relativistic scattering amplitude is given when the potential is of the Yukawa form or (by obvious extension) a suitable linear combination of such forms. The analytic properties of the scattering amplitude as a function of momentum transfer are established using only a finite sequence of equivalent definitions of the scattering amplitude. By studying the Born series for individual partial waves it is shown in addition that there cannot be an essential singularity at infinity. Together these results imply both dispersion relations for individual partial waves and the Mandelstam representation. (auth)

6743 AECU-4604(Paper 5)
Pennsylvania. Univ., Philadelphia.
CONVERGENCE OF THE BORN EXPANSION. Ronald Aaron and Abraham Klein. 26p.

The convergence of the iterated Born series for the Green's function in non-relativistic potential scattering is studied in n dimensions, thus generalizing a recent study of Zemach and Klein. For spherically symmetrical potentials the series is proved to converge at sufficiently high energies for a rather general class of potentials. (auth)

6744 AEEW-M-3
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England.
A GOLD–MANGANESE ACTIVATION DETECTOR FOR USE AT HIGH TEMPERATURES. F. R. Barclay and J. E. Sanders. May 1959. Decl. Aug. 1959. 10p. BIS.

A method of measuring the relative capture rates in Au and Mn based on activation foils containing both these elements in a Ni base is described. The method may be applied to measurements in high-temperature reactors. The foils were heated in air at 800°C for extended periods without detriment. (J.R.D.)

6745 AFBMD-TN-59-7
Avco Corp. Avco-Everett Research Lab., Everett, Mass.
THEORY OF THE SHOCK FRONT. II. HIGH TEMPERATURE REACTION RATES. Research Note 133. J. Derek Teare, Peter Hammerling, and Bennett Kivel. June 1959. 15p. Contracts AF04(647)-278 and DA-19-020-ORD-4862.

A re-examination is presented of the mechanism leading to O_2 Schumann-Runge radiation. A previous calculation predicted an overshoot above the equilibrium intensity in pure oxygen, in contradiction to experiments. A revised theory takes into account the de-excitation of the radiating state by collision. This mechanism, in conjunction with a small ($\simeq 10^{-20}$ cm^2) cross section for vibrational de-excitation, leads to predictions which do not overshoot. The rate constants for dissociation of nitric oxide and for the exchange reactions are discussed, and some conclusions are reached regarding their bounds. It is shown that the magnitude of the peak in NO concentration depends on many reactions while the tail is sensitive only to the rate of NO dissociation. The ionization rate in air is shown to be sensitive to only one rate constant, which has been measured by Lin. (auth)

6746 AFBMD-TN-59-9
Avco Corp. Avco-Everett Research Lab., Everett, Mass.
EXPERIMENTAL STUDIES OF SHOCK WAVES IN NITROGEN. Research Report 67. John C. Camm and James C. Keck. June 1959. 24p. Contracts AF04(647)-278 and DA-19-020-ORD-4862.

Radiative relaxation behind shock waves in pure nitrogen is being studied to determine rate constants for recombination of nitrogen atoms. The radiation was measured as a function of wavelength for conditions corresponding to T = 6600°K with $\rho = 0.018\ \rho_0$ and T = 6300°K with $\rho = 0.12\ \rho_0$. The most prominent radiation in the wavelength interval studied is associated with the N_2^+ (1−) and N_2 (1+) bands. The intensity histories exhibit strong overshoot in the shock front for both bands and the peak to equilibrium intensity ratio has been measured. Preliminary analysis of the final approach to equilibrium indicates that at 6400°K the recombination rate constant for N atoms is $< 0.3 \times 10^{-32}$ cm^6/sec when N_2 is the catalyst and 2.4×10^{-32} cm^6/sec when the N is the catalyst. (auth)

6747 ANL-6069
Argonne National Lab., Lemont, Ill.
THE OVERHAUSER EFFECT IN PARAMAGNETIC SYSTEMS. William A. Barker. Nov. 1959. 36p. Contract W-31-109-eng-38. OTS.

A discussion of the theory of the Overhauser nuclear polarization effect is presented, and particular attention is paid to the expected sign of the nuclear magnetization. A negative nuclear polarization in which the higher nuclear Zeeman levels are more populated than the lower energy levels could be used as a low-noise quantum mechanical amplifier of radiofrequency signals. Various systems are considered which might be investigated experimentally by simultaneous saturation of the electron or hole spin resonance and observation of an appropriate nuclear magnetic resonance frequency. Systems which should present interesting results include Be^9, donors in Ge, acceptors in Ge and Si, Ag^9Ag^+ in KCl, and F_2^- in LiF. References to most of the theoretical papers on the Overhauser effect and to all of the available experimental papers are included. Some of the more important papers on other double resonance methods are also listed. (J.R.D.)

6748 CEA-1267
France. Commissariat à l'Énergie Atomique, Paris.
MESURES DE FLUX RAPIDE A L'AIDE DE DETECTEURS A SEUIL SUR LE REACTEUR "MELUSINE." (Fast Flux Measurements by Means of Threshold Detectors on the Melusine Reactor). P. Léger and B. Sautiez. 1959. 25p.

Using existing data on the (n,p) and (n,α) threshold reactions, fast flux measurements were made on the swimming pool type reactor "Melusine." Four common elements: P, S, Mg, and Al were chosen because from the point of view of fast spectrum analysis they represent a fairly good energy range from 2.4 to 8 Mev. The fission flux value found in the central element at a power of 1 Mw is 1.4 ± 10^{13} n/cm^2/s ± 0.14. (auth)

6749 CF-59-9-114
Oak Ridge National Lab., Tenn.
THERMAL SHOCK OF HRT FLANGES. P. P. Holz. Sept. 29, 1959. 9p. Contract [W-7405-eng-26]. OTS.

In reactor operations such as venting or dumping, some of the HRT flanges are subject to rapid temperature changes. Tests were conducted using 0.5- and 1-in. reactor type ring joint flanges subjected to thermal shocks from 25 to 300°C, and from 300 to 25°C. No apparent flange leaks were noted. Bolt loadings following the tests were about the same in flanges having standard HRT carbon steel bolt-ferrules and in flanges having A-110AT titanium ferrules as well as in flanges having bolts without any ferrules. (auth)

6750 CF-59-12-54
Oak Ridge National Lab., Tenn.
THERMAL NEUTRON FLUXES IN HRE-2 DETERMINED

FROM ZIRCALOY-2 INDUCED ACTIVITY MEASUREMENTS, RUNS 16 AND 17. J. E. Baker, G. H. Jenks, and A. R. Olsen. Dec. 18, 1959. 8p. OTS.

Thermal neutron fluxes prevailing near some Zircaloy-2 specimens exposed during HRT run 17 and near others exposed during runs 17, 16, 14, and 13 were determined from measurements of the induced activity in the specimens. The neutron fluxes were calculated for an average core power level of 2 Mw. Flux values of 5.3 to 3.8×10^{13} neutrons/cm^2 sec were obtained for core screen specimens located 10.9 to 16.8 inches, respectively, below the core center. Values of 1.4 to 1.6×10^{13} neutrons/cm^2 sec were obtained for four specimens located in the reactor blanket region about 21 inches from the core center, and flux values for specimens from the core exit region, located about 34 to 53 inches from the core center, were calculated to have ranged from 6.2×10^{11} to 4.8×10^{10} neutrons/cm^2 sec. (auth)

6751 CU-194

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.
PROGRESS REPORT FOR APRIL, MAY, JUNE 1959 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 58p. Contract AT-30-1-GEN-72. OTS.

The Nevis neutron velocity selector was used to obtain data on the resonance levels of As, Br, I, and Th. The Th data were taken using a new $B^{10}(n,\alpha)Li^7$ flat detector capable of handling continuous counting rates of 7×10^5 counts/sec and having a 20% resolution for the cesium line. Work was completed on a new scintillation chamber of high resolution used to study the mass distribution in the fission of U^{235} by P-wave neutrons. Facilities for purifying, storing, and transferring large quantities of He^3 were completed. The neutron crystal spectrometer at BNL was used to measure the total U^{235} cross section over the wavelength range 1 to 10 A and to study neutron scattering from ammonium halides and manganese compounds at room and liquid nitrogen temperatures. Nuclear emulsion studies of neutrons from the $F^{19}(d,n)Ne^{20}$ reaction were made. Angular distributions of 4.43 Mev gamma-rays from the $C^{12}(p,p\gamma)C^{12}$ reaction were observed at several bombarding energies over the resonances corresponding to the 6.9 and 7.4 Mev compound nuclear levels, using the Van de Graaff generator. Further studies were made on the yields and gas transfer problems for the production of O^{15} and F^{17} by deuteron bombardment of N^{14} and O^{16}. A mixture of He^3 and He^4 was installed in the Van de Graaff terminal. The symmetries of the four fields involving γ_5 were investigated. A general rule is obtained which yields by inspection the relativistic corrections to the allowed beta decay. Instrument development is summarized. Beta-gamma correlation measurements using the magnetic beta spectrometer have conclusively shown the v/c proportionality throughout the region of v/c from 0.4 to 0.7. Characteristics are given for the high pressure xenon proportional counter. A transistorized fast coincidence spectrometer with a resolving time of 2×10^{-9} sec was developed. A very thin beta source of Pm^{147} was prepared and the polarization of the beta particles at 128 kev was measured by Mott scattering. (For preceding period see CU-191.) (W.D.M.)

6752 GEAP-3219

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
GROUP-DEPENDENT BOUNDARY CONDITIONS FOR ZOOM. B. A. Kerr and J. L. Russell, Jr. Aug. 10, 1959. 8p. Contract AT(04-3)-189, Project Agreement No. 4. OTS.

A procedure was developed for the insertion of arbitrary group-dependent boundary conditions in the UCRL IBM-7 program, ZOOM. It is a multigroup diffusion theory code which scattering from any energy group to any other group can be considered. A first-order approximation to the diffusion theory current boundary condition across an arbitrary boundary is obtained by the use of fictitious input parameters. (W.D.M.)

6753 HW-62858

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EQUATIONS OF STATE FOR STEAM–WATER MIXTURES AND SOME REPRESENTATIVE APPLICATIONS ANALYSIS. W. J. Love. Nov. 30, 1959. 20p. Contract [AT(45-1)-1350]. OTS.

Suggested equations of state are presented for two-phase water systems, and their use in certain critical, unsteady, and steady flow situations is demonstrated. The equilibrium equations of state for steam–water mixtures were determined for a pressure range of 10 to 3000 psia. The specific volume was determined as a function of pressure and enthalpy and as a function of pressure and entropy. These equations are not completely compatible, since the relations were determined directly. (W.L.H.)

6754 KAPL-2000-8

Knolls Atomic Power Lab., Schenectady, N. Y.
REACTOR TECHNOLOGY REPORT NO. 11—PHYSICS. Dec. 1959. 135p. Contract W-31-109-Eng-52. OTS.

Reactor Theory: A series of measurements of spatial flux transients introduced by hydrogenous gaps and absorbing slabs was made in the PPA. A few-group theory of water gap peaking is presented and compared with flux transient experiments. A method was developed in which diffusion theory and existing nuclear codes are utilized for the prediction of gamma energy distribution in reactor cores. SWAKRAUM, a two-region thermal space-energy code for the IBM-704, is described and calculations for the spatially dependent thermal spectrum near an interface between different media are compared with experiment. TRANVAR, a one-velocity slab geometry code for the calculation of certain space-energy problems, was generalized to permit up and down scattering in hydrogen. The problem is solved in two steps. At first, the one-velocity problem is solved when sources are assumed to be present in N distinct moderator slabs. The spectrum is next found by solving the coupled set of integral equations obtained when the source in each moderator region is expressed as an integral of the fluxes at different energies. The effects of chemical binding of molecules on the slowing down time of neutrons in water were investigated. Experimental Physics: Water-gap reactivity effects as a function of temperature were measured in highly enriched cores using the pressurized critical facility at KAPL and were compared with results of two-dimensional diffusion-theory calculations. A series of measurements of the core distributed reactivity coefficients of moderator and structural materials was made in a CH_2-moderated and -reflected slab reactor (PMA-6). The experiments were analyzed by means of various cross-section routines currently employed in nuclear design studies. Temperature coefficients were obtained from measurements made on 10 different cores and reflectors of the Pressurized Test Reactor. The critical temperature, temperature coefficient, and neutron density distribution were determined in the region from 68 to 550°F of an $8 \times 30 \times 32$ in. core having various wt.% B^{10}-stainless steel septa. The temperature dependence of plate equivalents for burnable poison pin arrays was investigated by a direct comparison technique in the PTR. Experiments described in this paper were conducted with critical reac-

tors covering a wide range of metal-to-water ratios, temperatures, loadings, and sizes and of very simple structure and geometry. Cross Sections: Reactor spectra effects on fission fragment cross sections were investigated. A measurement of the resonance integral of Zr^{91} was made on a 4 gm sample of ZrO_2. Magnesium cross sections were prepared for use as input for the MUFT code. Work on the influence of cross sections upon calculated neutron age and reactor criticality was undertaken in order to develop an understanding of Zr cross sections and to determine whether the usual computational techniques masked the effects of strong scattering resonances in O and Zr. Cross section values are given for Sm, Eu, and Gd. Burnable Poisons: Measurements are reported on the burnup of Eu and Dy under neutron irradiation in the form of Dy_2O_3 and Eu_2O_3 powder. The ratio of the amount of Eu^{152*} (9.2 hr) to Eu^{152} (13 yr) produced under neutron irradiation of Eu^{151} was measured. The particle self-shielding of boron carbide was investigated. Mathematical Theory and Methods: Work on advanced diffusion theory techniques, alternating-direction-implicit iteration technique, and code development is summarized. (For preceding period see KAPL-200-4.) (W.D.M.)

6755 NAA-SR-Memo-4578

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HEAT AND MASS TRANSFER ANALYSIS OF PROPOSED EXPERIMENTAL COLD TRAP SYSTEM. J. S. McDonald and F. Perez. Oct. 29, 1959. 28p. OTS.

Studies were made to investigate the possibility of removing oxide impurities from Na-cooled reactor systems by cold trapping in conjunction with fill-drain tanks. (W.L.H.)

6756 NAA-SR-Memo-4595

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

REVIEW OF ULTRASONIC THEORY AND APPLICATION WITH REGARD TO FEASIBILITY OF OPERATION IN ORGANIC REACTORS. D. G. Lilja. Nov. 11, 1959. 6p. OTS.

Studies were made to determine the feasibility of utilizing ultrasonic wave energy to assist in removal of fouling film from organic reactor fuel element heat transfer surfaces. Investigations were also made to determine whether in-core installation of ultrasonic transducer would prevent film formation. (W.L.H.)

6757 NAA-SR-Memo-4692

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THERMIONIC NUCLEAR FUELS FOR DIRECT CONVERSION REACTORS. S. M. Toy. Nov. 25, 1959. 8p. OTS.

A proposed program for the evaluation of thermionic nuclear fuels for direct conversion reactors is described. Physical and mechanical properties of selected thermionic metals, carbides, and oxides are given. (W.D.M.)

6758 NP-8178

Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences.

THE STUDY OF IONIZATION PHENOMENA BY HIGH VELOCITY MOLECULAR BEAMS. Semi-Annual Report No. 1. Glenn H. Miller and Nyle G. Utterback. June 1959. 40p. Contract NASW-13.

The aims of the investigation are to examine the potentialities of the neutralized ion beam as a molecular beam source and to measure the cross section for ionization for N_2–N_2 collisions from threshold up to several hundred electron volts for the incident molecular energy. The progress which was made and the ideas which evolved during the period are summarized. The lens system, ion source, charge exchange tube calculations, and beam monitors are discussed in some detail. (W.D.M.)

6759 NP-8207

Chicago. Univ. Inst. for the Study of Metals.

THIRD ANNUAL REPORT, OCTOBER 1958–OCTOBER 1959, TO ONR ON HIGH PRESSURE RESEARCH. SERIES II. 83p. Contract Nonr-2121(03).

Experiments at high pressures are described. Papers are presented on the theory of diffusion in crystals, quenching of lattice defects in noble metals under hydrostatic-pressure, measurements of diffusion at 800 to 1000°C, internal friction in iron at low temperatures, amorphous quartz formation under shock, behavior of under static high pressure, diffusion of cadmium in pure and cadmium doped AgBr, relations of Eyring and Doolittle diffusion equations, effect of pressure on self-diffusion in lead, method for obtaining x-ray-diffraction patterns from substances exposed to high pressure, high-pressure microwave window design, and diffusion impurities in amorphous polymers. Abstracts for individual papers were prepared. (J.R.D.)

6760 NP-8207(p.1-20)

Chicago. Univ. Inst. for the Study of Metals.

ON THE DYNAMICAL THEORY OF DIFFUSION IN CRYSTALS. III. SOME MODEL CALCULATIONS AND RELATION TO CONTINUUM THEORY. A. W. Lawson, Stuart A. Rice, Roger D. Corneliussen, and Norman H. Nachtrieb. 20p.

Models are considered which permit exact evaluation of the various dynamic parameters of the crystal diffusion theory previously proposed. The models considered suggest that the jump frequency is insensitive to the normal mode modifications produced by the adjacent vacancy, there is considerable relaxation about a vacancy, and the volume of formation of a vacancy is related to the molar volume by

$$\Delta V^* \approx \frac{V}{(\gamma_G + 1/3)}$$

where γ_G is the Gruneisen constant. The restrictions of the models are briefly analyzed and the mass dependence proposed by Bak and Prigogine is compared with the quasi-equilibrium model and the discrepancy discussed. (auth)

6761 NP-8207(p.21-4)

Chicago. Univ. Inst. for the Study of Metals.

PRELIMINARY EXPERIMENT ON THE QUENCHING OF LATTICE DEFECTS IN NOBLE METALS UNDER HYDROSTATIC PRESSURE UP TO 8500 BARS. Carl Tomizuka and Rodney Lowell. 4p.

Experiments were conducted in which the quenching rate of platinum wire was measured at 750 to 1050°C under various pressures of nitrogen. It was found that the quenching rate is reasonably constant at 300 to 8500 atm. The feasibility of this type experiment to determine the activation volume for the formation of defects (ΔV_F) was thus established. (J.R.D.)

6762 NP-8207(p.25-6)

Chicago. Univ. Inst. for the Study of Metals.

DIFFUSION MEASUREMENTS UNDER PRESSURE IN THE TEMPERATURE RANGE 800-1000°C. Carl Tomizuka and Rodney Lowell. 2p.

Proposals for experiments to provide quantitative information on the activation volume for self-diffusion in noble metals are discussed. The design of a high-temperature,

high-pressure furnace assembly is described, and the possibility of measuring diffusion coefficients to ±3% are explored. (J.R.D.)

6763 NP-8207(p.27-8)
Chicago. Univ. Inst. for the Study of Metals.
INTERNAL FRICTION IN IRON AT LOW TEMPERATURES. L. J. Bruner. 2p.

Measurements of the internal friction were made on annealed and cold worked iron at 4.2 to 350°K. Data are summarized graphically, and a typical loss curve for cold worked copper is included for comparison. Results show that the internal friction increases with decreasing temperature reaching a maximum at about 50°K and maintaining this value to the lowest temperature reached. (J.R.D.)

6764 NP-8207(p.29-30)
Chicago. Univ. Inst. for the Study of Metals and Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
THE FORMATION OF AN AMORPHOUS FORM OF QUARTZ UNDER SHOCK CONDITIONS. Paul S. De Carli and John C. Jamieson. 2p.

Results of a series of tests in which quartz samples were examined after exposure to shock are discussed. The samples were exposed to pressures of 348 to 600 kilobars. Appearance of an amorphous form of SiO_2 was noted and explanations are offered for these effects. Similar reactions in other materials are investigated. (J.R.D.)

6765 NP-8207(p.31-3)
Chicago. Univ. Inst. for the Study of Metals.
A NOTE ON THE BEHAVIOR OF IRON UNDER STATIC HIGH PRESSURES. John C. Jamieson. 3p.

It is pointed out that the resistance of iron is anomalous in that it apparently behaves like that of a Debye Solid rather than as expected in transition metals. Methods of calculating the Debye temperature are presented and data on the properties of iron at 0 to 175 kb are tabulated. The data are also used to explain the increasing deviation of the thermodynamic calculations at higher pressures. (J.R.D.)

6766 NP-8207(p.34-54)
Chicago. Univ. Inst. for the Study of Metals.
DIFFUSION OF CADMIUM IN PURE AND CADMIUM DOPED AgBr (thesis). J. Hanlon. 21p.

The diffusion of Cd in pure AgBr and dilute $CdBr_2$–AgBr solutions was measured by a tracer technique using carrier Cd^{109}. The association energy ΔG of Cd^{2+} was extrapolated to 0°K and listed as 0.21 ± 0.04 ev. The observed concentration dependence of Cd diffusion in doped samples can be explained if the mobility is assumed to have a strong concentration dependence. (J.R.D.)

6767 NP-8207(p.55-6)
Chicago. Univ. Inst. for the Study of Metals.
THE RELATION BETWEEN THE EYRING AND DOOLITTLE DIFFUSION EQUATIONS. A. W. Lawson. 2p.

The equation for viscosity of paraffins in the form $\eta = Ae^{Bv/V_F}$ where A and B are constants, V is the volume, and V_F is the free volume estimated from the expansion of the material from absolute zero is discussed in relation to the equation $D = a^2\nu e^{\Delta S/R - \Delta H/RT} = a^2\nu e^{-\Delta G/RT}$ where a is the jump distance, ν a lattice vibration frequency, T the absolute temperature, and ΔS, ΔH, and ΔG are the entropy, enthalpy, and free energy of activation, respectively. These two relations are shown to be almost equivalent for solids. (J.R.D.)

6768 NP-8207(p.57-64)
Chicago. Univ. Inst. for the Study of Metals.
THE EFFECT OF PRESSURE ON SELF-DIFFUSION IN LEAD. Norman H. Nachtrieb, Henry A. Resing, and Stuart A. Rice. 8p.

Data are presented for the self-diffusion of lead as a function of temperature from 174 to 320°C and at 1 to 8000 atm. A relationship is presented to express the decrease in self-diffusion coefficient with pressure. Also, several relationships are derived from thermodynamic considerations of the activated state and are shown to be valid experimentally. (J.R.D.)

6769 NP-8207(p.65-73)
Chicago. Univ. and Chicago. Univ. Inst. for the Study of Metals.
A NEW DEVICE FOR OBTAINING X-RAY DIFFRACTION PATTERNS FROM SUBSTANCES EXPOSED TO HIGH PRESSURE. John C. Jamieson, A. W. Lawson, and N. D. Nachtrieb. 9p.

A device is described for obtaining power diffraction patterns of thin sheets pressed between opposing diamond pistons. The unit is designed to replace the sample mount of standard x-ray-diffraction unit. Sample patterns taken on two of the high-pressure modifications of Bi are included. (J.R.D.)

6770 NP-8207(p.74-8)
Chicago. Univ. Inst. for the Study of Metals.
A HIGH-PRESSURE MICROWAVE WINDOW. A. W. Lawson and George E. Smith. 5p.

Tapered single crystals of Al_2O_3 are used to effect a high-pressure seal and provide a matched transformation from a standard 1-cm circular waveguide at atmospheric pressure to a circular waveguide terminated by a high Q cavity resonator with an internal hydrostatic pressure up to 10^4 bars. (auth)

6771 NP-8207(p.79-83)
Chicago. Univ. Inst. for the Study of Metals.
DIFFUSION OF IMPURITIES IN AMORPHOUS POLYMERS. A. W. Lawson. 5p.

It is pointed out that the diffusion of inorganic impurities in amorphous polymers appears to obey the same type of empirical relations which describe self diffusion in inorganic systems. The relations pertinent to this case are given and data for various impurities diffusing into polyvinyl acetate are tabulated along with data on the diffusion of impurities into various amorphous polymers. (J.R.D.)

6772 NP-8242
Duke Univ., Durham, N. C.
DUKE MICROWAVE LABORATORY REPORT NO. 27 [FOR] AUGUST 1, 1959–NOVEMBER 1, 1959. 107p. Project No. R-357-10-6. Contract AF18(600)-497.

With this are bound: ELECTRON SPIN RESONANCE OF AN IRRADIATED SINGLE CRYSTAL OF ALANINE: SECOND ORDER EFFECTS IN FREE RADICAL RESONANCES. Ichiro Miyagawa and Walter Gordy. (AFOSR-TN-59-1208); ELECTRON SPIN RESONANCE STUDIES OF MECHANISMS FOR CHEMICAL PROTECTION FROM IONIZING RADIATION. Walter Gordy and Ichiro Miyagawa. (AFOSR-TN-59-1209).

In the electron spin resonance of an irradiated single crystal of alanine interesting second order effects were discovered which are associated with an admixture of the nuclear spin states of the free radical by the off-diagonal terms in the $\vec{I} \cdot \vec{S}$ interaction. The theory of these effects was worked out and shown to agree well with the observations on alanine. The theory should be useful in the study of many other crystals where similar second order effects probably complicate the spin resonance spectra at certain frequencies. Certain chemicals, most of which contain sulfur, are known to provide a measure of protection to

animals from ionizing radiations if the chemical is in the body at the time of the irradiation. The method of electron spin resonance was used to investigate the mechanism of action of certain of these protective compounds. The studies indicated that the sulfur protectors can protect protein molecules by becoming temporarily bonded to side groups of the protein and supplying electrons to fill vacancies made by the ionizing radiations. The studies also provide evidence that certain protein chains are photoconducting. (See also NP-7250.) (W.D.M.)

6773 NP-8249

Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

ESTUDIO EXPERIMENTAL DE LA RELACION DE NORDHEIM. Informe No. 20. (Experimental Study of the Nordheim Relationship. Report No. 20). Juan A. Chamero. 1959. 12p.

A usual method for the measurement of the reactivity variation on poison removal from a critical reactor consists in the measurement of the stable period of the neutron flux increase and utilization of the Nordheim relation. It is possible in a subcritical reactor to compare one reactivity with another by measuring the neutron flux levels after the introduction of reactivity. The results obtained by both methods are compared in the present work. Using a standardized poison at a given point of the core a value δk measured for the stable period is obtained. In the subcritical reactor equal poisons are added to the standard in positions symmetrical with respect to the center of charge of the core and the reactivities are compared; thus it is proved that within certain limits there is additivity of the reactivities, or an associated reactivity $n\delta k$ corresponds to n standard poisons. In a second experiment such poisons were extracted in a critical regime and the stable periods resulting from the extractions were measured. These experimental periods were compared with those predicted by the Nordheim relation. As the parameters differ according to source, comparisons were made with different sets of values. In all cases the agreement between the measured period and the calculated period was shown to be within the errors of the method. (tr-auth)

6774 NP-8267

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

EQUILIBRIUM HYDRODYNAMIC VARIABLES BEHIND A NORMAL SHOCK WAVE IN HYDROGEN. Eugene B. Turner. Aug. 26, 1958. 15p. Contract AF04(647)-165. (GM-TR-0165-00460).

A complete calculation was performed on the hydrodynamic variables for shock Mach numbers up to and beyond the point where hydrogen becomes completely ionized. A set of curves is presented for initial pressures of 10^{-2}, 10^{-3}, and 10^{-4} atmospheres including density ratio across the shock wave, the temperature behind the shock wave, and the degree of ionization. (W.D.M.)

6775 NP-8270

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

SOME CONSIDERATIONS CONCERNING MAGNETOHYDRODYNAMIC EXHAUST CONTROL FOR ROCKET GUIDANCE. Wulf B. Kunkel. Feb. 20, 1959. 15p. Contract AF04(647)-309. (TR-59-0000-00608).

Some of the requirements for magnetohydrodynamic steering of rocket exhausts are discussed. It is concluded that the present exhaust temperatures (near 3000°K) are too low and the gas densities (near atmospheric) too high to make the scheme more than barely marginal even if adequate seeding with cesium is assumed. It is further found that the presence of halogens in the exhaust renders the method impossible because of the large fraction of alkali halides formed. The difficulties experienced with the present propulsion systems are illustrated by treating as an example the most favorable case of Aerojet Polyurethane near the nozzle throat region where the temperature is highest. (auth)

6776 NP-8272

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

EQUILIBRIUM HYDRODYNAMIC VARIABLES BEHIND A REFLECTED SHOCK WAVE IN HYDROGEN. Eugene B. Turner. June 30, 1959. 19p. Contract AF04(647)-309. (TR-59-0000-00744).

Hydrodynamic variables such as density ratio, pressure ratio, temperature, fraction of dissociation and ionization, and the reflected shock velocity were calculated for a reflected shock wave in hydrogen for one dimension. The data are presented as families of curves of these variables plotted against the initial shock Mach number for a range of unity to 200 with the initial pressure as a parameter. Hydrodynamic equations are derived which include the effects of dissociation, ionization, and atomic excitation. Reference is made to a previous report for the hydrodynamic variables behind the initial shock wave in hydrogen which were used in these calculations. Deviations from the so called "strong shock approximation" are quite large, especially in the regions where the gas is being dissociated or ionized. The density and pressure ratios across the reflected shock wave may be two to three times greater with a corresponding decrease in the reflected shock velocity and the temperature. (auth)

6777 ORO-231

Virginia. Univ., Charlottesville. Research Labs. for the Engineering Sciences.

IONIZATION YIELD IN GASES. Technical Status Report [for] December 1, 1956–December 31, 1957. Glenn H. Miller and Ralph A. Lowry. 14p. Contracts AT(40-1)-1820 and AF49(638)-22, Project No. 47501. OTS.

The investigation is concerned with the ionization yield as a function of energy for various ions in various gases and gas mixtures. The energy range is from 20 to 200 kev and the gases are H, He, Ne, Ar, N, CO_2, and air. During 1959 the program was chiefly concerned with procurement, building, and testing of equipment. (W.D.M.)

6778 ORO-232

Virginia. Univ., Charlottesville. Research Labs. for Engineering Sciences.

IONIZATION YIELD IN GASES. Technical Status Reports [for] January 1, 1958–December 31, 1958. Glenn H. Miller and Ralph A. Lowry. 21p. Contracts AT(40-1)-1820 and AF49(638)-22, Project No. 47501. OTS.

Assembly and testing of the experimental apparatus were completed, and preliminary measurements were made of the ionization yield of 50-kev protons in argon. (For preceding period see ORO-231.) (W.D.M.)

6779 PB-151657

Naval Research Lab., Washington, D. C.

THERMOELECTRICITY ABSTRACTS. Mildred Benton, comp. May 1959. 110p. OTS.

An accumulation of unclassified references resulting from a search of abstract journals, indexes, and bibliographies on thermoelectricity is presented. 620 references including abstracts are given. (J.R.D.)

6780 PB-151810
Naval Research Lab., Washington, D. C.
THERMOELECTRICITY ABSTRACTS. Mildred Benton, comp. Aug. 1959. 79p. OTS.

A second accumulation (first listing dated May 1959) of unclassified references resulting from a search of abstract journals, indexes, and bibliographies on thermoelectricity is presented. 1021 references including abstracts are given. (J.R.D.)

6781 SCTM-94-59(81)
Sandia Corp., Albuquerque, N. Mex.
REPORT ON MICROWAVE PROPAGATION CHARACTERISTICS OF U 12E TUNNEL, NEVADA TEST SITE, MERCURY, NEVADA. James F. Barham and Stewart A. Ingham. Nov. 1959. 40p. OTS.

An experiment to determine the feasibility of a tunnel microwave telemetry system is described. Telemetry signals, using carrier wave frequencies of 3.85 and 4.05 kmc, were propagated over a one-mile distance in the u12e tunnel at the Nevada Test Site. The average attenuation produced by the tunnel link was comparable to that of a free space propagation link, and telemetry, signals retained reasonable information fidelity and signal-to-noise ratios. (auth)

6782 UCRL-5683
California. Univ., Livermore. Lawrence Radiation Lab.
SOME IMPORTANT PARAMETERS OF THE PLASMA DIODE. Raymond Fox. Nov. 1959. 30p. Contract W-7405-eng-48. OTS.

A relationship is derived that predicts the power radiated from the cathode to the anode of the plasma diode. The radiated power loss predicted by this relationship for a tungsten cathode and a nickel anode at widely different temperatures is found to be five times greater than the prediction of the conventional relationship which assumes gray-body conditions. The effective work functions of the cathode and anode are found to be a function of the electrode separation and the grain sizes of the cathode and anode materials. An upper limit of the thermoelectric power output of the cesium plasma is evaluated and found to be small compared with the total electrical power output of the diode. Two nonconventional methods are described for obtaining a high heat-converter efficiency with the plasma diode. One method uses barium vapor for depressing the cathode work function and cesium vapor for space-charge neutralization. In the second method, the cathode is at such a high temperature that there is appreciable evaporation of cathode material. The efficiency of the plasma diode is derived for the case when electron scattering is small. The efficiency is given as a function of the temperatures, work functions, and emissivities of the cathode and anode, and the electrical and thermal conductivities of the electrical leads. (auth)

6783 UMRI-03043-1-T
Michigan. Univ., Ann Arbor. Research Inst.
TOTAL COLLISION CROSS SECTIONS FOR THE INTERACTION OF MOLECULAR BEAMS OF CESIUM CHLORIDE WITH GASES. INFLUENCE OF THE DIPOLE-DIPOLE FORCE UPON THE SCATTERING. Hugo Schumacher, Richard B. Bernstein, and Erhard W. Rothe. Jan. 1960. 26p. Contract AT(11-1)-321. OTS.

Total cross sections (Q) for the interaction of CsCl beams with a number of molecules were measured using an apparatus of 1 minute angular resolution in which the temperature of the scattering gas could be varied from 200 to 735°K. The temperature dependence of Q was studied for argon, CH_4, CH_2F_2, CHF_3, CF_4, NO, H_2S, NH_3 and for cis- and trans- CHCl = CHCl. Values of Q at 300°K were measured for eight additional gases. (J.R.D.)

6784 WADC-TR-54-409(Pt. IV)
Oklahoma Agricultural and Mechanical Coll., Stillwater. Inst. of Tech.
UNCONVENTIONAL ELECTRICAL POWER SOURCES. Paul A. McCollum. Sept. 1957. 37p. Project title: ELECTRICAL GENERATION EQUIPMENT. Task title: STUDY AND RESEARCH PROGRAM ON UNCONVENTIONAL ELECTRICAL POWER SUPPLIES. Contract AF33(616)-2237. (AD-142321).

The research was directed toward gaining additional information concerning the parameters related to thermopile operation, and also to compile information relative to the conversion of nuclear energy to electrical energy. Thermopiles made of metal sheets were analyzed and tested. These types appear to be able to deliver more power per unit weight and volume than those made of wires. The literature was reviewed for nuclear conversion methods and a presentation of the various techniques are included. (auth)

6785 AEC-tr-3936
INVESTIGATION OF CURRENT DISTRIBUTION IN AN ELECTROLYZER MODEL. M. F. Dogramadzhi. Translated for Los Alamos Scientific Lab. from Tsvetnye Metally 32, No. 8, 44-50(1959). 10p. JCL or LC.

Experimental measurements on a sand-model showed the non-uniformity of potential on the anode bottom. The significant difference between potentials of the various points depends upon the distance between the current-carrying rod and the anode bottom. The center of the anode bows up to 16 mm toward the electrolyte—depending on the potential values. This accounts for the lack of constancy of the inter-electrode distance. A significant increase in anode current density is obtained by lengthening of the rods to 95 cm. (for a 2.5 meter wide anode). The molten metal surface is equipotential. Current flow along the rod is non-uniform because of inadequate rod length. The lengthening of the rod reduces overheating of individual anode sections. Electric field of the electrolyte showed that its anode and cathode current densities are practically equal. The transverse horizontal currents in the metal are small, and the induced magnetic forces are insignificant. The side surface of the anode accounts for 5% of the current. (auth)

6786 CEA-tr-A-317
PROBLÈMES DE CONTRÔLE PHYSICO-CHIMIQUE DES PILES ATOMIQUES. ETUDE PARTICULIÈRE DES MESURES DE CONDUCTIBILITÉ ET DE pH. ANALYSES DES GAZ. (Problems of the Physico-Chemical Control of Atomic Reactor. Particular Study of Conductivity and pH Measurements. Gas Analysis). S. Block. Translated into French by B. Moreau from Atomkernenergie 2, 18-25 (1957). 29p.

A survey was made of physico-chemical problems in the control systems of many reactor types. In particular, conductivity and pH measurement in coolant streams and gas analyses are treated. At the same time the importance of these factors is pointed out. Some apparatus used for these purposes is described. (T.R.H.)

6787 CEA-tr-X-178
RÉCIPIENTS POUR LE RADIOISOTOPE ^{60}Co. (Containers for the Radioisotope Co^{60}). Z. Frynta and J. Langmajer (Langmayer). Translated into French from Jaderná energie 4, 98-102(1958). 16p. (Includes orig., 7p.).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12042.

6788 UCRL-Trans-102

ON THE STATISTICAL THERMODYNAMICS OF BINARY SOLUTIONS. (Sur la Thermodynamique Statistique des Solutions Binaires). I. Prigogine and G. Garikian. Translated by Bonnie E. Cushman (Univ. of California Radiation Lab.) from Physica 16, 239-48(1950). 16p. (Includes orig., 10p.). JCL.

The effects of binary mixture concentration changes on the vibration frequency of molecules in the mean field of their neighbors were examined. Also, the effects of volume changes with concentration on thermodynamic functions were studied in these mixtures. The Lennard-Jones and Devonshire Models were extended in the study of the mixtures at temperatures far from the critical point. Formulas relative to pure liquids are considered along with binary form mixtures of non-polarized molecules, the effects of volume composition, excess free energy, entropy excess, and the validity of the model. (J.R.D.)

6789 UCRL-Trans-125

THE YIELD COEFFICIENT U OF THE CHARACTERISTIC K RADIATION AND THE RELATION BETWEEN IONIZATION OF THE AIR AND THE ENERGY OF X-RAY. Enno Arends. Translated by Henry P. Kramer (Univ. of California Radiation Lab.) from Ann. Physik (5) 22, 281-310 (1935). 30p. JCL.

The determination of the yield coefficient (u) of characteristic K radiation was determined by means of purely monochromatic x radiation. The primary and secondary radiations were measured in the same fixed ionization chamber. The fraction $F(\lambda)$ of the x-ray energy which falls on an air column 20 cm in length was determined and used in the redetermination of u for Fe, Ni, Cu, Zn, Se, Mo, Ag, and Sn. Values of u were established within 1% at Z = 25 to 35 and within 3% at Z = 35 to 50. (J.R.D.)

6790

A USEFUL ANALYTIC APPROXIMATION TO ATOMIC AND UNITARY ATOMIC SCATTERING FACTORS. J. N. Silverman and S. H. Simonsen (Univ. of Texas, Austin). Acta Cryst. 13, 50-4(1960) Jan. (In English)

Atomic scattering factors for C, N, O, Cl, Cl^-, Ni^{2+}, Ni, Zn^{2+}, Zn, Pd^{2+}, and Pd were approximated by least-squares parameters and fifth-degree polynomial coefficients. A method for calculating the unitary atomic scattering factor is presented. (C.J.G.)

6791

DIRECTING INTENSE PHOTON BEAMS BY ELECTRON GAS MIRRORS. Eugene Sänger (Forschungsinstitut für Physik der Strahlantriebe e. V., Stuttgart-Flughafen). Astronaut. Acta 5, 266-86(1959). (In German)

Radiation intensities of roughly 10^9 cal cm^{-2} sec^{-1}, as required for photon propulsive jets and for weapons beams, can, for example, be realized through black radiation of heavy plasmas of 150,000 °K. To direct parallely and to focus this radiation, reflection degrees of at least (1 to 10^{-6}) within the wavelength range between 10^{-7} and 10^{-4} cm are required of the reflectors. Such a reflective power cannot be expected of mirrors consisting of solid, or liquid bodies, probably neither of superconductors. To realize electron densities of roughly 10^{27} cm^{-3} required for mirrors of such a reflective power, however, appears in principle imaginable by means of very heavy compression shocks of the plasma itself, and, perhaps even more easily, by means of compression shocks of pure electron gas. (auth)

6792

THE GRAVITATIONAL FIELD OF A PARTICLE POSSESSING A MULTIPOLE MOMENT. G. Erez and N. Rosen (Israel Inst. of Tech., Haifa). Bull. Research Council Israel, Sect. F. 8, 47-50(1959) Sept.

Using the method of Weyl and Levi-Civita, a procedure is proposed for calculating the metric tensor describing the gravitational field of a particle possessing a mass multipole moment. Calculations are carried out for the case of a quadrupole moment. (auth)

6793

ON THE PHOTOELECTROLUMINESCENCE OF ZnS-Cu. Karel Pátek (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 8, 612-13(1958). (In Russian)

Investigations of ultraviolet radiation effects on the course of instant luminosity in Zn-Cu revealed an irregular increase during the intense cycle. An intense increase of the integral luminosity was observed, followed by an increase of the mean electroluminescence maximum and a slow disappearance of the secondary maximum. (R.V.J.)

6794

THE LOCAL SENSITIVITY OF PHOTO-MULTIPLIER PHOTO-CATHODES. Jiří Skřivánek and Mikuláš Kuzmiak (Inst. of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 112-17(1959). (In Russian)

The influence of the non-uniform distribution of the sensitivity of a photo-multiplier photo-cathode on the spectrum shape of the output pulses from a scintillation detector is studied. Methods of scanning the local sensitivity and determining its distribution function are described. The theory was compared qualitatively with measurement on a slow-neutron detector from a mixture of zinc sulfate and boric acid. (auth)

6795

ON NEUTRALIZING THE CHARGE OF STATIC ELECTRICITY BY RADIOACTIVE RADIATION. N. G. Drosdov and V. N. Egorov. Elektrichestvo No. 10, 63-7(1959) Oct. (In Russian)

Problems related to the selection of radiation sources are analyzed, and experimental data on neutralization of electric charges are quoted. (R.V.J.)

6796

A THEORY OF ELECTROMAGNETICALLY DRIVEN SHOCK WAVES. J. K. Wright and M. C. Black (Atomic Weapons Research Establishment, Foulness, Essex, Eng.). J. Fluid Mech. 6, 289-301(1959) Aug.

The general theory of experimental devices for the generation of strong shock waves in gases by electromagnetic forces on current-carrying gas particles is discussed, taking external circuit inductance into account. It is shown that a shock wave of constant speed is finally attained. This shock wave is travelling at 90% of its final speed when the circuit inductance has increased to 3.0 times its initial value. (auth)

6797

CONTINUUM EQUATIONS IN THE DYNAMICS OF RAREFIED GASES. Max Krook (Harvard Univ., Cambridge, Mass. and Smithsonian Astrophysical Observatory, Cambridge, Mass.). J. Fluid Mech. 6, 523-541(1959) Nov.

A procedure is given for translating boundary-value problems of gas dynamics from microscopic form into approximately equivalent continuum form. The continuum formulations involve state-variables that are either half-space moments, or complete moments of the molecular distribution functions. Moment equations derived

from the kinetic equations are reduced to a determinate set by representing the distribution functions as sums of modified Maxwellian functions based on various characteristic temperatures and velocities. The particular choice of such a representation depends on the Knudsen number and on the nature of the microscopic boundary conditions. (auth)

6798

VAPOUR PRESSURE OF ISOTOPIC LIQUIDS. [PART] I. A, N_2, O_2 BELOW BOILING-POINT. G. Boato, G. Scoles, and M. E. Vallauri (Università, Genoa and Istituto Nazionale di Fisica Nuclear, Genoa). Nuovo cimento (10) 14, 735-47(1959) Nov. 16. (In English)

A static equilibration method was used to measure the single stage separation factor α of isotopic pairs in the vapor liquid equilibrium of Ar, N_2, and O_2 below the boiling point. Since the corresponding isotopic mixtures are supposed to be ideal, the vapor pressure ratio of the studied isotopic liquids is identical to α. The separation factors at the boiling point were found to be the following: $Ar^{36} - Ar^{40}$, $\alpha = 1.0060 \pm 0.0001$; $O_2^{16} - O^{16}O^{18}$, $\alpha = 1.0050 \pm 0.0001$; and $N_2^{14} - N^{14}N^{15}$, $\alpha = 1.0037 \pm 0.0001$. The temperature dependence was established in all cases in a relatively narrow range of temperatures. A discussion of the argon results in the light of the quantum theorem of corresponding states is given. (auth)

6799

TRACK DISTORTION IN A LIQUID HYDROGEN BUBBLE CHAMBER. R. Budde, A. Burger, H. Filthuth, Y. Goldschmidt-Clermont, H. M. Mayer, D. R. O. Morrison, Ch. Peyrou, and J. Trembley (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 778-86(1959) Nov. 16. (In English)

Tracks of 270 Mev pions in a 10 cm hydrogen bubble chamber were measured. As a test of track distortion, the curvature of the parabola fitted to the points and the dispersion of these points were calculated. With flash delays of 1 and 2 msec the curvature in the middle region of the chamber was almost the same as that expected from multiple scattering showing that the convection currents which are used in the thermostatisation system do not produce general distortions in the useful volume of the chamber. (auth)

6800

EQUATIONS OF MOTION FOR RENORMALIZED FIELDS. F. L. Scarf (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 849-55(1959) Nov. 16. (In English)

Solutions to conventional equations of motion are generally well-defined only in the "wrong" Hilbert space with all antiparticle states filled. The meaningful quantity which can be renormalized is a Wick product of some functional of the physical particle operators. When the field theory has infinite wave function renormalization, there is no direct connection between the two representations for the field operators. An example is given for which the two forms have different space-time developments. (auth)

6801

A NOVEL DISPERSION RELATION FOR POTENTIAL SCATTERING. A. Klein and B. W. Lee (Univ. of Pennsylvania, Philadelphia). Nuovo cimento (10) 14, 856-71(1959) Nov. 16. (In English)

A dispersion relation for potential scattering is found which holds without restriction on momentum transfer. The integral in the relation involves a completely non-physical amplitude. It is shown that in combination with the unitarity condition that the Born series, in the event that it converges, can be completely determined. The transition to the more customary relation is also carried through. (auth)

6802

EXCITON SPECTRUM OF CADMIUM SULFIDE. D. G. Thomas and J. J. Hopfield (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 116, 573-82(1959) Nov. 1.

The reflectance and fluorescent spectra of hexagonal CdS crystals were measured at 77° and 4.2°K using polarized light in the region of 5000 A. Structure not previously reported was found in the reflectivity curves which leads to the identification of three exciton series. These can be understood in terms of the splitting of the valence band into three levels at $k = 0$. The observation of excited exciton states and the polarization properties of the excitons make possible: (1) The determination of two of the three exciton binding energies, (2) the determination of the energy splittings of the three valence bands, (3) the verification of the symmetry assignments of the valence and conduction bands, and (4) correlation of the work of others with the present work, showing that the definite intrinsic effects are consistent both with our observations and our interpretations. The fluorescence experiments strongly suggest that the radiative decay of excitons occurs not directly, but from localized impurity exciton states in agreement with theory. (auth)

6803

TRIPLET INTERVALS OF HELIUM. Gentaro Araki, Masao Ohta, and Koichi Mano (Kyoto Univ.). Phys. Rev. 116, 651-3(1959) Nov. 1.

The triplet intervals of the deepest P-state of helium are calculated by making use of the wave function recently determined. The polarization of the s-orbital, the admixture of the singlet, and the quantum-electrodynamic fourth-order correction are all taken into account. The theoretical values of the intervals are $^3P_0 - {}^3P_1 = 997.457\ 11 \times 10^{-4}$ cm^{-1} and $^3P_1 - {}^3P_2 = 75.974\ 45 \times 10^{-3}$ cm^{-1}. (auth)

6804

THE DENSITY MATRIX IN MANY-ELECTRON QUANTUM MECHANICS. I. GENERALIZED PRODUCT FUNCTIONS, FACTORIZATION AND PHYSICAL INTERPRETATION OF THE DENSITY MATRICES. R. McWeeny (University Coll. of North Staffordshire, Eng.). Proc. Roy. Soc. (London) A253, 242-59(1959) Nov. 24.

Many-electron wave functions are usually constructed from antisymmetrized products of one-electron orbitals (determinants) and energy calculations are based on the matrix element expressions due to Slater (1931). The orbitals in such a product are replaced by "group functions," each describing any number of electrons, and the necessary generalization of Slater's results is carried out. It is first necessary to develop the density matrix theory of N-particle systems and to show that for systems described by "generalized product functions" the density matrices of the whole system may be expressed in terms of those of the component electron groups. The matrix elements of the Hamiltonian between generalized product functions are then given by expressions which resemble those of Slater, the "coulomb" and "exchange" integrals being replaced by integrals containing the one-electron density matrices of the various groups. By setting up an "effective" Hamiltonian for each electron group in the presence of the others, the discussion of a many-particle system in which groups or "shells" can be distinguished (e.g. atomic K, L, M, ... shells) can rigorously be reduced to a discussion of smaller subsystems. A single generalized product (cf. the single determinant of Hartree-Fock theory) provides a convenient first approximation; and the effect of admitting

"excited" products (cf. configuration interaction) can be estimated by a perturbation method. The energy expression may then be discussed in terms of the electron density and "pair" functions. The energy is a sum of group energies supplemented by interaction terms which represent (i) electrostatic repulsions between charge clouds, (ii) the polarization of each group in the field of the others, and (iii) "dispersion" effects of the type defined by London. All these terms can be calculated, for group functions of any kind, in terms of the density matrices of the separate groups. Applications to the theory of intermolecular forces and to π-electron systems are discussed. (auth)

6805

MONTE CARLO CALCULATIONS OF GAMMA-RAY BACKSCATTERING. Martin J. Berger and Dominic J. Raso (National Bureau of Standards, Washington, D. C. and Army Chemical Center, Edgewood, Md.). Radiation Research 12, 20-37(1960) Jan.

Monte Carlo calculations have been performed to determine the backscattering of γ-rays with energies between 0.02 and 2.0 Mev from hydrogen, water, concrete, iron, tin, and lead. The radiation was assumed to be incident on a semi-infinite medium, either isotropically, or at angles of 0 (perpendicular incidence), 30, 60, or 90° (grazing incidence). Several thousand photon histories were sampled with the use of an IBM 704 computer to determine the albedo for each case. The information obtained includes the number albedo and energy albedo, the energy distribution of reflected radiation integrated over all directions, the angular distribution integrated over all energies, the angular distribution of the reflected energy, the average energy of the photons reflected in various directions, and the average obliquity of emergence of the reflected radiation as a function of the γ-ray energy. Tables of albedo and illustrative energy spectra and angular distributions are presented. (auth)

6806

QUANTUM-MECHANICAL CALCULATION OF THE ADIABATIC POTENTIALS OF LUMINESCENCE CENTER IN KCl(Tl) IN ONE-OSCILLATOR APPROXIMATION. N. N. Kristofel. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 3-37(1959). (In Russian)

It is shown that the activator interacts mainly with holosymmetrical localized vibration mode. A method for taking into account shifts of the cations of type (200) was proposed. On the basis of the quantum-mechanical method the adiabatic potentials were calculated for the ground and excited ($^3P_1$) states of a luminescence center in KCl(Tl). The shifts of equilibrium positions of ions, holosymmetrical local oscillation frequencies, energy of the substitution of K^+ for Tl^+, cohesion energy, and the equilibrium distance between ions in KCl were obtained. Absorption and emission spectra of a luminescence center ($^1S_0 \longleftrightarrow {}^3P_1$) which were calculated by means of the adiabatic potentials obtained are in good agreement with experimental data. (auth)

6807

ON THE INFLUENCE OF THE HYDROSTATIC PRESSURE OF A PHOSPHOR ON THE ADIABATIC POTENTIALS OF A LUMINESCENCE CENTER. N. N. Kristofel. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 43-50(1959). (In Russian)

The influence of the hydrostatic pressure of KCl(Tl) on the adiabatic potentials of $^1S_0$ and $^3P_1$ states of a luminescence center is examined on the basis of the quantum mechanical method. The results are compared with the thermodynamic theory. A formula was derived for the effective surface of a luminescence center, which remains undetermined in the thermodynamic theory. (auth)

6808

INFLUENCE OF HIGH PRESSURE ON THE EMISSION AND EXCITATION SPECTRA OF ALKALI HALIDE PHOSPHORS. Ya. Ya. Kirs and A. J. Laisaar. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 51-67(1959). (In Russian)

The investigation deals with the influence of hydrostatic pressure (up to 6000 kg/cm^2) on the emission spectra of the phosphors KCl(Tl), KBr(Tl), NaCl(In), KCl(In), KBr(In), KI(In), KCl(Sn), and KCl(Pb) and on the excitation spectra of the phosphors KCl(In), KCl(Sn), and KCl(Pb). Increase in pressure leads to the shifting of the emission bands towards a shorter wavelength. The relative intensity of the shortwave band increases in the phosphors having two emission bands. The excitation bands are shifted under the influence of pressure towards a longer wavelength. Shifts in the emission spectra are probably directly connected with a change in the energy of electronic transitions in the centers of luminescence. From the point of view of the thermodynamic theory decrease in the energy of these transitions under the pressure means that in the excited state of the luminescence center the equilibrium separation between the activator ion and its immediate environment is smaller than in the ground state. To explain the changes in the emission spectra one has to assume that the activator ions have two excitation levels, the energy gap between which is small. (auth)

6809

AN INVESTIGATION OF LUMINESCENCE CENTERS IN NaCl PHOSPHORS ACTIVATED BY MERCURY-LIKE IONS. N. E. Lushchik. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 68-96(1959). (In Russian)

Absorption, excitation, and emission spectra of NaCl phosphors activated by the ions Ga^+, In^+, Tl^+, Ge^{2+}, Sn^{2+}, and Pb^{2+} were investigated. The nature of the multiband emission spectra of NaCl(Ga), NaCl(Sn), NaCl(Tl), NaCl(Pb), and KCl(Tl) is analyzed. Separate emission bands in the case of the last three crystal phosphors are connected with different luminescence centers, consisting of an activator ion interacting with a slightly different immediate environment. (auth)

6810

AN INVESTIGATION OF LUMINESCENCE CENTERS IN ALKALI HALIDE PHOSPHORS WITH DIFFERENT CONCENTRATIONS OF THE ACTIVATOR AND MICRO-DEFECTS OF THE HOST LATTICE. I. PHOSPHORS ACTIVATED BY THALLIUM. T. A. Abdusadykov. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 97-121(1959). (In Russian)

Emission, excitation, and absorption spectra of alkali halide phosphors activated with thallium in the presence of different concentrations of the activator and defects in the host crystal are investigated. It is shown that in monoactivated phosphors there occur luminescence centers of at least two types. Their nature is discussed. (auth)

6811

AN INVESTIGATION OF LUMINESCENCE CENTERS IN ALKALI HALIDE PHOSPHORS WITH DIFFERENT CONCENTRATIONS OF THE ACTIVATOR AND MICRO-DEFECTS OF THE HOST LATTICE. II. PHOSPHORS ACTIVATED BY INDIUM, TIN AND LEAD. T. A. Abdusadykov. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 122-34(1959). (In Russian)

Spectral characteristics of alkali halide crystals activated with indium, lead, and tin, in the presence of high concentrations of the activator and other defects in the host lattice, were investigated. In phosphors in which the radius of the activator is larger than that of the cation of the host crystal two types of luminescence centers were discovered. (auth)

6812

RECOMBINATION PROCESSES IN ALKALI HALIDE CRYSTALS ACTIVATED BY GALLIUM. Ch. B. Lushchik and E. S. Tiisler. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 135-65(1959). (In Russian)

This is a study of the recombination luminescence of the phosphors NaCl(Ga), KCl(Ga), and KBr(Ga) occurring in the presence of electronic processes. The method used was based on the investigation of variations in the absorption spectra after x irradiation or subjection to ultraviolet light in the region of the activator or exciton absorption bands. Absorption data presented provide evidence of the creation of a number of electronic color centers. The possible mechanism of the migration of energy from the impurity center to the host crystal of the phosphor is discussed. (auth)

6813

SPECTRA OF EXCITATION OF THE RECOMBINATION LUMINESCENCE OF ALKALI HALIDE CRYSTAL PHOSPHORS. I. V. Yaek. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 166-95(1959). (In Russian)

An investigation was made of the excitation spectra of the recombination luminescence and the spectra of forming F centers in a number of alkali halide phosphors activated with Ga^+, In^+, and Tl^+, and also in the phosphor $CdBr_2$(Pb). It was shown that recombination luminescence is effectively excited in the region of activator absorption bands $^1S_0 \rightarrow {}^1P_1$, and also in the more shortwave region of the spectrum. At electron transitions $^1S_0 \rightarrow {}^3P_{1,0}$ in the activator ion the efficiency of recombination luminescence is ~200 times less. The spectra of excitation of phosphorescence are by several mμ shifted towards the shortwave side in comparison with the spectra of excitation of stationary emission. Recombination luminescence is also excited in the host-crystal absorption region, corresponding to the exciton absorption bands and to the transitions from zone to zone. It has been shown that in some alkali halide phosphors at excitation in the band $^1S_0 \rightarrow {}^1P_1$ recombination luminescence forms up to 30% of stationary emission. (auth)

6814

ON THE EXCITATION OF LUMINESCENCE IN THE FUNDAMENTAL ABSORPTION BANDS OF ALKALI HALIDE CRYSTAL PHOSPHORS. G. G. Liidya. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 196-208(1959). (In Russian)

The investigation deals with the quantum yield of the luminescence of the activator ions of alkali halide phosphors in case of excitation by ultraviolet light in the region of the absorption bands, corresponding to the excitation of the activator ions (η^{akm}), excitons (η^{ex}), and electrons from the valence band to the conduction band (η^{33}). It was observed that for KI(Tl), KI(In), and KI(Ga) $\eta^{akm} > \eta^{33} > \eta^{ex}$, for CsI(Tl), however, $\eta^{akm} > \eta^{ex} \approx \eta^{33}$. It was shown that in case of excitation in the region of the exciton absorption band the transfer of excitation energy from the host crystal to the activator must take place. This is evident from the yield being two orders higher than what might have been expected in case of lack of energy transfer. The dependence of η^{ex}/η^{akm} and η^{33}/η^{akm} on the concentration of the activator was studied for KI(Tl). At the excitation in the region of the long-wave edge of the absorption band, corresponding to the transition "zone-zone" (193 mμ ≤ λ ≤ 199 mμ) the relative yield amounts to 0.8 if $c_{akm} \geq 6 \cdot 10^{-2}$ mole %. The electron-hole and exciton mechanism of the excitation of luminescence were examined. (auth)

6815

AN INVESTIGATION OF PHOTOELECTRIC POLARIZATION OF DIELECTRICS BY MEANS OF THE DYNAMIC CONDENSER METHOD. [PART] II. I. K. Vitol and I. A. Tale. Trudy Inst. Fiz. i Astron. Akad. Nauk Eston. S.S.R. No. 10, 220-38(1959). (In Russian)

A perfected method of studying photoelectric polarization with self-compensation is described. Results of investigation of kinetics, stationary values, and spectra of excitation of the photoelectric polarization in ZnS phosphors are given and discussed. Peculiarities of photoelectric polarization in dielectrics with medium-deep trapping levels and bipolar conductivity are examined. It was shown that, in principle, the investigation of photoelectric polarization allows not only the sign, but also the relation between the values of hole and electronic photoconductivity, to be determined. The effect of "antipolarization" in ZnS phosphors was discovered and the reasons giving rise to it were considered. (auth)

6816

THE THREE-DIMENSIONAL STABILIZATION OF CHARGED CARRIERS IN A QUADRUPOLE FIELD. E. Fischer (Universität, Bonn). Z. Physik 156, 1-26(1959). (In German)

It is shown that particles of a specific charge e/m are confined in three dimensions by a high frequency electric quadrupole field with the potential $\varphi = c \cdot U(t) \cdot (x^2 + y^2 - 2z^2)$. The confinement is mass selective. The theoretical predictions are verified by experiments with ions of different masses and with electrons. The mass selection, maximum number of stored charges, and their mean life time in the field are measured. Furthermore the influence of a magnetic field on the motion of the charges is investigated. (auth)

6817

A MEASUREMENT METHOD FOR THE INVESTIGATION OF FLUORESCENCE DECAY PROCESSES. Helmut Schl... (Justus-Liebig Universität, Giessen, Ger.). Z. Physik 156, 27-37(1959). (In German)

A method is described which permits the measurement of the temporal process of the fluorescence intensity in a decay time from 10^{-7} to 10^{-9} sec in excitation with cathode beams. The temporal intensity pattern was scanned point by point in analogy to the stroboscopic methods. The time resolution was 0.4 nsec. The rise and decay of anthracene, naphthalene, and three solid polyacene solutions, which contained a foreign component in various concentrations, were given. (tr-auth)

6818

THE THEORY OF PARTICLE SIZE DISTRIBUTION IN AEROSOLS. H. Koppe (Universität, Heidelberg, Ger.). Z. Physik 156, 211-16(1959). (In German)

A simple theory of that part of the variation of the particle sizes in an aerosol, which originates from the spatial non-homogeneous distribution of the condensation nuclei, is given. In the hypothesis, purely statistically distributed nuclei result when the relative dispersion of the masses

the colloidal particles is equal to the fourth root of the fraction of the total volume which is occupied by the colloidal particles. (tr-auth)

4819

DEMONSTRATION OF AMPLITUDE AND PHASE MODULATION. R. W. Pohl. Z. Physik 156, 271-4(1959). (In German).

Two simple mechanical auxiliaries are described with which one can produce amplitude and frequency or phase modulation and can apply a frequency or phase modulation to an amplitude modulation. (tr-auth)

4820

THE INTENSIFICATION AND EXTINCTION OF THE LUMINESCENCE OF MANGANESE-ACTIVATED ZINC SULFIDE BY ELECTRIC FIELDS. H. Gobrecht and H.-E. Gumlich (Technische Universität, Berlin). Z. Physik 156, 436-45(1959). (In German)

The results of further investigation on the effect of electric fields on the luminescence of manganese-activated zinc sulfide, excited by x or ultraviolet beams, are given. From the dependence of the electrophotoluminescence of this material on the type and intensity of the exciting radiation and on the intensity and frequency of the electrical field, the conclusion was drawn that the field intensification of the powdered manganese-activated zinc sulfide is not explainable as the radiation-controlled Destriau effect, but rather that a transport mechanism exists. (tr-auth)

4821

SPECTROSCOPIC INVESTIGATIONS WITH THE HELP OF α PARTICLES. P. Harteck, S. Dondes, and P. Rentzepis (Rensselaer Polytechnical Inst., Troy, N. Y.). Z. Physik 156, 522-4(1959). (In German)

Excitation of the molecules of various gaseous substances by α particles from a polonium-210 source was investigated, especially with respect to the branching between dissociation and γ deexcitation. The use of an alternative irradiation source is briefly discussed. (auth)

4822

MEASUREMENT OF LUMINESCENCE-DECAY TIMES OF INORGANIC PHOSPHORS BY IONIC EXCITATION. A. Scharmann (Universität, Gissen, Ger.). Z. Physik 157, 301-15(1959) Nov. (In German)

An experimental setup for measuring luminescence-decay-times after excitation by ions is described. The measuring range extends down to about 10^{-7} sec. The decay of luminescence of $MgWO_4$, $ZnWO_4$, $CdWO_4$, $CaWO_4$, CsJ/Tl and NaCl/Ag proved to be exponential and independent of wavelength. Due to high excitation density quenching of luminescence occurs at the beginning of the decay. Hence decay is more rapid as ion mass is increased. Changing ion-energy between 10 and 60 kev shows no measurable influence on decay time. Luminescence of ZnS/Cu decreases hyperbolically, decay depending on ion-energy, ion-pulse-duration, and ion-mass. The blue emission band of ZnS/Mn shows similar behavior. The orange-colored Mn-emission band of ZnS/Mn shows exponential decrease and strong dependence on concentration. (auth)

4823

THE DECAY OF LUMINESCENCE OF ZnS/Cu, ZnS/S, ZnS/Zn, and ZnO/Zn BY EXCITATION WITH 60-kev H_2^+-ION PULSES. Karl Heinz Härdtl (Universität, Gissen, Ger.). Z. Physik 157, 316-25(1959) Nov. (In German)

ZnS/Cu ($5 \cdot 10^{-5}$), (10^{-3}), (10^{-4}), (10^{-5}), ZnS/S, ZnS/Zn, and ZnO/Zn were excited by 60 kev-H_2^+-ion-pulses and the decay of luminescence was investigated. All phosphors show increasing decay times as ion-pulse-duration is increased. This increase can be calculated from the partial superposition of the single-ion-pulses. If pulses last longer than 3 μsec the experimental decay-time-values for ZnS/Cu ($5 \cdot 10^{-5}$), (10^{-3}) are larger than the calculated ones, which is attributed to the influence of traps; for ZnS/Cu (10^{-4}), (10^{-5}), ZnS/S, ZnS/Zn, and ZnO/Zn they are smaller, which might be explained by partial coincidence of excitation-canals. ZnS/Cu, ZnS/S, and hex ZnS/Ag show more rapid decay in the short wavelength region of their emission-spectra as compared to the part consisting of longer wavelength. Measurements with α-particles were made for comparison. (auth)

6824

SOME EXPERIMENTAL RESULTS ON THE ANGULAR INTENSITY DISTRIBUTIONS OF BACKSCATTERING AND TRANSMISSION FROM AN ISOTROPIC P^{32} β SOURCE ON THICK AND THIN PLANE SCATTERING MEDIA. William L. Buys (Univ. of Ghent). Z. Physik 157, 478-89(1960). (In English)

The P^{32} saturation backscattering component, named side scattering by Seliger, is verified and further investigated for thin Al foils in connection with transmission, by means of a simple small solid angle Geiger counter method. Variations occurring in the side scattering angular distribution, due to surface effects, are illustrated and can explain some errors in absolute beta counting, and are related to results reported by Kanter. (auth)

6825

COMBINATIONAL SCATTERING OF ELECTROMAGNETIC WAVES IN FERROMAGNETIC DIELECTRICS. F. G. Bass and M. I. Kaganov (Inst. of Radiophysics and Electrons, Academy of Sciences, Ukrainian SSR and Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret Fiz. 37, 1390-3(1959) Nov. (In Russian)

Combinational scattering of electromagnetic waves by oscillations of the magnetic moment is predicted. The extinction coefficient for the scattered radiation is calculated. (auth)

6826

DETECTION OF Eu^{2+} IONIZATION IN SrS–Eu Sm PHOSPHORS BY PARAMAGNETIC ABSORPTION METHOD. V. V. Antonov-Romanovskii, V. G. Dubinin, A. M. Prokhorov, Z. A. Trapeznikova, and M. V. Fok (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 37, 1466-7 (1959) Nov. (In Russian)

A reduced paramagnetic absorption of Eu^{2+} was revealed in SrS–Eu, Sm phosphors during excitation by light. At excitation the paramagnetic absorption is ~15% while ten minutes after excitation it is ~8%. It is postulated that about 8% of Eu^{2+} is ionized. The data confirm the detection of $Eu^{2+} \rightarrow Eu^{3+}$ activator during the excitation. (R.V.J.)

6827

ANOMALOUS HEAT CAPACITY AND NUCLEAR RESONANCE IN CRYSTALLINE HYDROGEN IN RELATION TO THE NEW DATA ON ITS STRUCTURE. S. S. Dukhin (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1486-8(1959) Nov. (In Russian)

The anisotropy of nuclear resonance in hydrogen monocrystals was estimated in an attempt to verify the hydrogen structure. (R.V.J.)

6828

GROUP THEORY AND ITS APPLICATION TO THE QUANTUM MECHANICS OF ATOMIC SPECTRA. Eugene P. Wigner. Pure and Applied Physics. Volume 5. Translated from the German by J. J. Griffin. New York, Academic Press, 1959. 381p.

The application of group theoretical methods to problems of quantum mechanics is described. The elements of linear vector theory and the rudiments of quantum mechanics are discussed. The mathematical aspects of group theory such as abstract group theory, invariant subgroups, continuous and rotation groups, three-dimensional pure rotation group, direct product representations, and the algebra and general theory of representations are contained. The characteristics of atomic spectra, a description of electron spin and fine structure of spectral lines, and the calculation of total angular momentum quantum number are discussed. The selection and intensity rules with spin and the selection rules of spectral lines are given. The partial determination of eigenfunctions from their transformation properties is described. A discussion of the recoupling (Racah) coefficients, the time inversion operation, and the classical interpretations of the coefficients is given. (C.J.G.)

6829

PLUTONIUM–THORIUM ALLOYS. F. W. Schonfeld (to U. S. Atomic Energy Commission). U. S. Patent 2,904,429. Sept. 15, 1959.

New plutonium-base binary alloys useful as liquid reactor fuel are described. The alloys consist of 50 to 98 at.% thorium with the remainder plutonium. The stated advantages of these alloys over unalloyed plutonium for reactor fuel use are easy fabrication, phase stability, and the accompanying advantage of providing a means for converting Th^{232} into U^{233}.

6830

LOW VOLTAGE 14 Mev NEUTRON SOURCE. R. N. Little, Jr. and E. R. Graves (to U. S. Atomic Energy Commission). U. S. Patent 2,906,903. Sept. 29, 1959.

An apparatus yielding high-energy neutrons at the rate of 10^8 or more per second by the D,T or D,D reactions is described. The deuterium gas filling is ionized by electrons emitted from a filament, and the resulting ions are focused into a beam and accelerated against a fixed target. The apparatus is built in accordance with the relationship $V_s = A - B \log pd$, where V_s is the sparking voltage, p the gas pressure, and d the gap length between the high voltage electrodes. Typical parameters to obtain the high neutron yields are 55 to 80 kv, 0.5 to 7.0 ma beam current, 5 to 12 microns D_2, and a gap length of 1 centimeter.

Astrophysics and Cosmology

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SOLAR WINDS. Eugene N. Parker. Nov. 1959. 27p. OTS.

Lecture delivered at Sandia Corp., Albuquerque, N. Mex.

It is suggested that corpuscular radiation is hydrodynamic expansion of the solar corona which is called solar wind. Arguments are presented for this expansion of the solar corona in terms of motion of the comet tail aurorae production, magnetic storms, and cosmic-ray effects on earth. The corona is taken to be isothermal out to an undefined distance (in multiples of the radius of the base of the corona) and from there it expands adiabatically until supersonic velocities are reached at infinity. The solar wind is considered to continue after five astronomical units on the spiralling solar magnetic field. Applications of the solar wind hypothesis to solar sailing are discussed. (C.J.G.)

6832

GENERAL RELATIVISTIC CONSIDERATIONS ON COSMOLOGY. H. Hönl and H. Dehnen (Universität, Freiburg i B.). Z. Physik 156, 382-98(1959). (In German)

The age of the world was calculated as a function of the Hubble constants and the cosmic mass density and was discussed on the basis of Sandage's new astronomical data with respect to the abundance of uranium isotopes. The probable mean cosmic mass density was 5×10^{-29} g/cm³. "Bicentric" statistical solutions of the gravitation field equations were indicated for a closed (finite) cosmos and the Mach principle is explained in the relationship with an example (two rotating liquid spheres). (tr-auth)

Cosmic Radiation

6833 AECU-4566

California. Univ., Berkeley.

NUCLEAR INTERACTIONS IN CARBON PRODUCED BY COSMIC RAYS WITH ENERGIES BETWEEN 10^{10} AND 10^{12}ev. Luisa F. Hansen and W. B. Fretter. Dec. 1959. 45p. Sponsored by ONR and AEC under Contract Nonr-222(40). OTS.

An experiment is described in which high energy nuclear interactions in the range of energies 10^{10} to 10^{12} ev were analyzed by means of a cloud chamber in a magnetic field. Measurements of ionization and momentum made possible the identification of electrons and π-mesons to about 20 Bev/c. Protons, K-mesons, and hyperons could not be identified unambiguously among themselves, except in very limited regions of momentum. The primary particles were cosmic-ray nucleons and a possible fraction of pions, the target nuclei were carbon and the velocities of the primaries were determined from balance of momentum in the center of mass system. A total of 41 events were analyzed and the results compared to previous experimental work and the predictions of the theories of Heisenberg and Landau. The measurements made included the transverse momenta of the secondaries and their average energy in the CMS, the energy and angular distribution of the pions and heavy particles (protons, K-mesons, hyperons) in the CMS, the inelasticity of the collision, the multiplicity of the showers, the percentage of strange particles, and the positive excess of the secondaries. (auth)

6834

EFFECTS OF Pi MESON DECAY-ABSORPTION PHENOMENA ON THE HIGH-ENERGY Mu MESON ZENITHAL VARIATION NEAR SEA LEVEL. J. A. Smith and N. M. Duller (Univ. of Missouri, Columbia). J. Geophys. Research 64, 2297-2305(1959) Dec.

An approximate calculation of the ground-level high-energy μ meson intensities is presented, with curves showing peculiar maxima in the angular vicinity from about 55 to 75° with respect to the vertical at ground-level energies from about 60 to 160 Bev. The effects are explained in terms of well known π meson decay-absorption phenomena high in the earth's atmosphere. (auth)

6835

THE MOMENTUM SPECTRUM OF COSMIC RAYS AT A DEPTH OF 38 METRES WATER EQUIVALENT UNDERGROUND. F. Ashton and A. W. Wolfendale (Univ. of Durham, Eng.) and W. F. Nash (Univ. of Nottingham, Eng.). Proc. Roy. Soc. (London) A253, 163-76(1959) Nov. 24.

A direct determination was made of the cosmic-ray

spectrum underground at a depth of 38 m.w.e. under Castle Rock, Nottingham. The spectrum is based on measurements of 1010 particles traversing a magnetic spectrograph having a maximum detectable momentum of 8 Bev/c. By comparing this spectrum with the ground-level spectrum the energy loss of fast μ-mesons in penetrating the 38 m.w.e. of rock was determined. It is shown that the energy loss for μ-mesons in the momentum range 7 to 15 Bev/c is as expected by theory, the collision process being responsible for most of the loss. (auth)

6836

EXPERIMENTS ON COSMIC RADIATION BY MEANS OF ARTIFICIAL SATELLITES. C. F. Powell (Univ. of Bristol, Eng.). Proc. Roy. Soc. (London), A 253, 482-7 (1959) Dec. 29.

An account is presented of the primary aspects of cosmic radiation, and the methods of measuring the radiation are outlined. A comparison of proposed radiation studies by artificial satellites, as opposed to the use of balloons and airplanes, is made on the basis of information gained and cost. The estimated cost is coupled with securing satisfactory design and performance and a solution to the recovery problem. The proposed satellite method would be more beneficial in that the sampling time could be extended, the detector made larger, and the measurements made at higher altitudes. (B.O.G.)

6837

ON THE MICROSTRUCTURE OF THE CORE OF EXTENSIVE AIR SHOWERS. S. N. Vernov, G. V. Kulikov, Z. S. Strugalskii, and G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1193-6(1959) Nov. (In Russian)

Experimental data are presented which indicate the presence of well-collimated particle beams in the cores of extensive air showers. Various possible explanations of the observed phenomenon are considered. (auth)

6838

INVESTIGATION OF THE HIGH ENERGY μ-MESON FLUX IN BROAD ATMOSPHERIC SHOWERS. S. N. Vernov, B. A. Khrenov, and G. B. Khristiansen. Zhur. Eksptl'. i Teoret. Fiz. 37, 1252-65(1959) Nov. (In Russian)

Experimental data on the possible existence of the narrow beams of μ mesons (diameter in observation plane >0.5 m) were obtained with aid of an arrangement which permits one to study simultaneously broad atmospheric showers on the surface of the earth and underground. Data on broad atmospheric showers obtained at the surface of the earth can be employed to construct a picture of generation of the narrow μ meson beams. (auth)

6839

ENERGY OF ELECTRON-PHOTON COMPONENT OF WIDE ATMOSPHERIC SHOWERS. S. N. Vernov, V. A. Dmitriev, V. I. Solov'eva, and G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1481-2 (1959) Nov. (In Russian)

The energy of the electron-photon component in a wide atmospheric shower was measured at 0.1 to 1000 m above sea level. The total energy is proportional to the total number of particles in the shower. The energy of the electron-photon component is $E = (2.7 \pm 0.3)\beta N$, where β is the critical air energy. At 100 m < r < 1000 m the function of the energy flux distribution is expressed as $\rho_E(r) \sim r^{-(2.6\pm0.2)}$. The mean energy per electron at various distances from the shower axis is plotted. (R.V.J.)

6840

THE RADIATION PROBLEM IN LOW THRUST SPACE TRAVEL. Andrew D. Babinsky, Michael G. Del Duca, and Angus F. Bond (Thompson Ramo Wooldridge, Inc., Cleveland). New York, American Rocket Society, 1959. 14p.

The magnitude of radiation received in low-thrust traversal of the Van Allen belts is estimated. These estimates indicate that the total radiation received can be controlled by the proper selection of launch and orbit parameters. The shielding requirements of a vehicle are discussed relative to payload and protection of the crew. (C.J.G.)

Criticality Studies

6841 GAT-DM-787

Goodyear Atomic Corp., Portsmouth, Ohio.

PROGRAM FOR COMPUTING K_∞ FOR URANIUM SALTS. T. B. Patterson. Nov. 4, 1959. 5p. OTS.

An IBM-650 program for computing K_∞ for optimumly moderated uranium salt systems in even numbered assays between 2 and 100% was written in Bell II format. The program permits calculation of K_∞ for an assay in a system containing not more than nine elements other than uranium. (C.J.G.)

6842 GAT-DM-792

Goodyear Atomic Corp., Portsmouth, Ohio.

PROGRAM FOR COMPUTING MINIMUM CRITICAL SPHERE RADII FOR URANIUM SALTS. T. B. Patterson. Nov. 27, 1959. 5p. OTS.

An IBM-650 program for computing the minimum critical sphere radii for optimumly moderated systems of uranium salts at various assays was written. The program was checked out and is identified as Deck Number 690. (J.R.D.)

6843 HW-61054

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NEUTRON AGE CALCULATIONS (HOMOGENEOUS SYSTEMS). N. Ketzlach. July 10, 1959. 6p. Contract AT(45-1)-1350. OTS.

An equation for neutron age as a function of composition for homogeneous systems was derived, taking into account the slowing down and transport cross section terms. Neutron age for enriched uranyl fluoride (~90% U-235) in water was calculated by the equation as a function of H/U-235 using 27 cm^2 as the neutron age in pure water. For H/U-235 values >200 there is essentially no water displacement. For H/U-235 values <55 the rate of increase of neutron age is controlled by the rapid displacement of water by fuel. The neutron age at an H/U-235 value of 45 is about 29.8 cm^2. For such H/U-235 ratios, the effect of epithermal captures on reactivity is discussed. (C.J.G.)

6844 RFP-158

Dow Chemical Co. Rocky Flats Plant, Denver.

PLUTONIUM GRAPHITE ASSEMBLIES—PART II. A. Goodwin, Jr. and C. L. Schuske. Aug. 10, 1959. Decl. Dec. 9, 1959. 21p. Contract AT(29-1)-1106. OTS.

Neutron multiplication measurements were made on a number of cylindrical assemblies of Pu and graphite disks. S_n calculations were made on homogeneous mixtures of Pu and graphite with varying C/Pu ratios and varying reflector thickness. (auth)

Elementary Particles

6845 AD-217019

Pittsburgh. Univ.

INELASTIC COLLISION CROSS SECTIONS FOR PROTONS

AND ATOMIC HYDROGEN ON MOLECULAR HYDROGEN. Technical Report No. 8 [on] CAPTURE-LOSS AND IONIZATION CROSS-SECTIONS OF IONS AND NEUTRAL PARTICLES. R. Curran and T. M. Donahue. Apr. 1959. 43p. Contract Nonr-624(06).

Measurements of the single electron capture cross section, σ_{10}, for protons of energies 2.5 to 60 kev and measurements of single electron capture and loss cross sections for atomic hydrogen, σ_{0f} and σ_{01} respectively, over the same energy range are reported. Reported for the first time are measurements of the total cross section for production of ion pairs by hydrogen atoms in molecular hydrogen. A result of the measurements of electron loss by hydrogen atoms is an apparent correlation with H^- formation cross sections for electron impact on molecular hydrogen. (auth)

6846 AEEW-M-18

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith, Dorset, England.

THE METHOD OF FEINBERG GALANIN. D. C. Leslie. Oct. 1959. 22p. BIS.

The current status of the Feinberg-Galanin theory of heterogeneous assemblies is surveyed. The aim of the Feinberg-Galanin procedure is the calculation of the spatial distribution of neutrons in a single thermal group. (W.L.H.)

6847 AFOSR-TN-59-1295

Maryland. Univ., College Park.

HIGH ORBITAL S-STATE CAPTURE OF π^--MESONS BY PROTONS. Physics Dept. Technical Report No. 159. T. B. Day, G. A. Snow, and J. Sucher. Dec. 1959. 9p. Contracts AF49(638)-24 and AT(40-1)-2504. OTS.

The time which elapses between that point in the slowing down of a π^--meson in liquid H_2 when it has a velocity $v \simeq 0.05c$ and the moment of capture by a proton was recently measured to be $\simeq 3.5 \times 10^{-12}$ sec. The result is considered from the Stark effect and capture process previously proposed for the K^-,p) atom. It is concluded that the number is so restrictive that the Stark effect process cannot explain the capture rates of pions in hydrogen. (W.D.M.)

6848 AFOSR-TN-60-12

Maryland. Univ., College Park and Wisconsin. Univ., Madison.

$|\Delta I| = \frac{1}{2}$-RULE AND THE WEAK FOUR-FERMION INTERACTION. Technical Report No. 160. S. Oneda, J. C. Pati, and B. Sakita. Dec. 1959. 11p. OTS.

If it is assumed that all the strangeness-violating interactions are characterized by a weaker coupling constant, then the faster rates of strangeness-violating non-leptonic processes appear hard to understand. Previously it was stressed that this difficulty may be solved in connection with the $|\Delta I| = \frac{1}{2}$ rule. This possibility is demonstrated in more detail by considering the Λ-decay and by a study of the implication of the charged vector-meson for this problem. (W.D.M.)

6849 HW-62501

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NEUTRON AGE IN GRAPHITE-WATER LATTICES. D. E. Simpson. Oct. 28, 1959. 3p. Contract AT(45-1)-1350. OTS.

The Fermi age of thermal neutrons in a lattice containing both water and graphite is some sort of weighted average of the age in water and in graphite independently, with correction for volumes of non-moderating elements or voids. The correct weighting function has been in question during design calculations for the NPR. A very simple and direct approach to the problem is presented, resulting in a weighting equation which seems to be theoretically sound. (W.D.M.)

6850 NP-8276

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

SCATTERING OF PARTICLES AND QUANTUM MECHANICS. M. I. Shirokov. 1959. 11p. (P-395).

As is known one need not do all possible polarization experiments for a phase-shift analysis of π-p or p-p scattering. There exists a so-called necessary and complete set of experiments. It is shown that the "redundancy" of some remaining experiments is a consequence of the main features of the quantum mechanics formalism and is due to the description of the states with wave functions. The establishment of the equality between the calculated and the measured results of the "redundant" experiments will thus constitute a check of the fundamental quantal postulates. Experiments of such a kind have already been performed but the accuracy should be considerably improved for this purpose. (auth)

6851 NP-8277

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

ELASTIC SCATTERING OF NEGATIVE PIONS BY PROTONS AT ENERGIES 128 AND 162 Mev. Yu. A. Budagov, S. Wiktor, V. P. Dzhelepov, P. F. Yermolov, and V. I. Moskalev. 1959. 27p. (P-402).

The elastic scattering angular distribution of negative pions by protons was measured by means of a hydrogen-filled diffusion cloud chamber in a magnetic field. 344 and 941 elastic scattering events were recorded at the angles $\delta\theta > 10°$ cm. The total cross sections for elastic scattering at 128 Mev = $(12.8 \pm 1.0) \times 10^{-27}$ cm^2 and at 162 Mev = $(21.4 \pm 1.2) \times 10^{-27}$ cm^2 were determined by calculating the total length of negative pion tracks in the chamber. (auth)

6852 NP-8278

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

DETERMINATION OF THE COUPLING CONSTANT OF PION-NUCLEON INTERACTION BY DIFFERENTIAL CROSS SECTIONS FOR ELASTIC n-p SCATTERING AT 630 Mev. N. S. Amaglobeli, B. M. Golovin, Yu. M. Kazarinov, S. V. Medved', and N. M. Polev. 1959. 5p. (P-430).

The coupling constant of the π-n interaction was determined by a measurement of the differential cross section for elastic n-p collisions at 630 Mev at 160 to 180° cm. Measurements were taken by using a ring-shaped scatterer and a detector for recording recoil protons. (W.D.M.)

6853 TOI-58-8

Technical Operations, Inc., Burlington, Mass.

A TRANSPORT CALCULATION OF THE NET CURRENT OF PHOTONS IN AN INFINITE ISOTROPICALLY SCATTERING NON-ABSORBING ATMOSPHERE. John F. Batter, Jr. Mar. 1958. 18p. Contract DA-29-044-XZ-587. (AFSWP-1052; AD-158775).

Results are presented of some approximate calculations to determine the net current of photons impinging on a specimen perpendicular to a radius from the source, in the region close to the source. The solution, while reasonably valid for dimensions large compared to the mean free path, predicts photon currents smaller than are realistic near the photon source. The general solution of the problem is presented and then specialized for the case of no absorptions. (W.D.M.)

6854 UCRL-8980
California. Univ., Berkeley. Lawrence Radiation Lab.
POLARIZATION OF BREMSSTRAHLEN (thesis). John M. Dudley. Nov. 13, 1959. 49p. Contract W-7405-eng-48. OTS.

The partial polarization of bremsstrahlen originating from a well-collimated beam of electrons incident upon a thin radiating target was observed. Detection of the polarized radiation was by the angular dependence of deuteron photodisintegration. A survey of the currently available theoretical treatments of the phenomenon is presented; a modification of the theory to include the effect of multiple scattering in the radiator is suggested. For incident electron total energy E_0 = 25.5 Mev, the fractional degree of plane polarization of bremsstrahlen from a 1-mil aluminum radiator, with photon energies in a band about 5 Mev, observed at an angle 1.5 mc^2/E_0 radians from the center of the bremsstrahlen beam, is found to be $\Pi = 0.44 \pm 0.22$, in agreement with the modified theoretical prediction, Π = 0.45. (auth)

6855 WADC-TN-58-256
Wright Air Development Center. Propulsion Lab., Wright-Patterson AFB, Ohio.
COMPARISON OF MONTE CARLO CALCULATION AND EXPERIMENTAL MEASUREMENTS FOR GAMMA-RAY AIR SCATTERING. David M. Dawson, William L. Kirk, Vincent W. Shiel, and William P. Johnson. Aug. 1958. 25p. (AD-206051).

Convair has reported an experimental determination of the angular distribution and energy spectrum of air scattered gamma-rays from a cobalt-60 source. Lynch, et. al., reported the results of a Monte Carlo study of gamma-ray air scattering from a monoenergetic beam source which was performed at WADC on the Remington Rand 1103 digital computer. This program was modified to perform similar calculations for a monoenergetic, point isotropic source. The code was further modified to print separately photon currents due to first collisions, to second collisions, to third collisions, and to all higher order collisions. The angular distribution and energy spectra as reported by Convair are compared with the results of Lynch, et. al., and with results obtained with the modified program. In general, the agreement between theory and experiment is within a factor of two. (auth)

6856 UCRL-Trans-507
THE ABSORPTION OF ALPHA PARTICLES IN FILTER PAPER AND IN MEMBRANE ULTRAFILTERS. Zenon Starcuk and Jaroslav Kutzendörfer. Translated from Jaderná energie 3, 290-2(1957). 7p. JCL.

The alpha activity of natural radioactive aerosol retained from the air by membrane ultrafilters, Whatman No. 4 filter paper, and by an electrostatic precipitator, was measured. The absorption of alpha particles in membrane ultrafilters and in filter paper was determined on the basis of the values obtained. The study includes equations for the determination of the concentration of radon in air on the basis of measuring the alpha activity of captured natural radioactive aerosol. (auth)

6857
A SIX-DIMENSIONAL RIEMANNIAN MANIFOLD, ITS APPLICATIONS TO MESO-ELECTRODYNAMICS, AND A SYSTEMATIZATION OF STRONGLY INTERACTING PARTICLES. Jerzy Rayski (Jagellonian Univ., Krakow and Inst. of Physics, Polish Academy of Sciences, [Warsaw]). Acta Phys. Polon. 18, 371-85(1959). (In English)

A conception of a six-dimensional world enables a geometrical interpretation of the electric charge, charge conjugation, gauge transformations, and of the electromagnetic field. The same conception explains satisfactorily the isospin, its connection with the electric charge, and the ps-scalar character of nuclear forces. Several qualitative and some quantitative properties of strongly interacting particles (strangeness, rest masses, etc.) find an intuitive explanation within this geometrical framework. (auth)

6858
ELECTRON DIFFRACTION IN PASSAGE THROUGH A THIN FILM OF MATERIAL. L. Brú, R. Márquez, and F. Ramos (Instituto de Optica "Daza de Valdés," Madrid). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55, 229-32(1959) Sept.-Oct. (In Spanish)

A study was made of the behavior of a beam of electrons after passing a film of absorbing material. Gold was used as absorbing material as well as diffracting material. There is no appreciable difference between the normal electron diffraction patterns and that obtained using a film of absorbing material. (auth)

6859
THE PHOTON AS A COMPOSITE PARTICLE. Nathan Rosen and Paul Singer (Israel Inst. of Tech., Haifa). Bull. Research Council Israel, Sect. F. 8, 51-62(1959) Sept.

The photon is treated as a system consisting of a neutrino and an anti-neutrino, each of zero rest mass and described by a four-component wave function, with a delta-function interaction between them. The Dirac equation for this system is solved by the auxiliary use of a proper coordinate system on the assumption at first that the total rest energy and the interaction range are different from zero and then that these approach zero. Solutions are thus found representing "localized" states for which the external motion is described by the Maxwell equations for empty space while the internal motion is limited to a very small region. If one restricts the interaction to a single type, it turns out to be either vector or pseudo-vector. Two neutrinos or two anti-neutrinos do not form such a composite photon. Likewise, the use of two-component neutrino wave functions fail to give such a photon. (auth)

6860
PHOTON SPIN IN THE PHENOMENOLOGICAL THEORY OF ELECTROMAGNETIC FIELDS. Čestmír Muzikář (Karlsuniversität, Prague). Czechoslov. J. Phys. 8, 501-9 (1958). (In German)

A continuation of a previous study (Muzikář, C. Czechoslov. J. Phys. 6, 409(1956)) is presented. It is first shown that as the motion of dielectrics is toward a convection of polarization, it likewise comes about that the vector to which the perpendicular corresponds generally does not have the direction of motion of waves or photons. It is further shown that the spin of photons is $\pm\hbar/\lambda^2$ for the radiation tensor and $\pm\hbar$ for the Minkowsky tensor. The question of which tensor is correct is referred to the practicality of an experimental decision. (tr-auth)

6861
ENERGY LEVELS OF AN ELECTRON IN THE FIELD OF A FINITE DIPOLE. Richard F. Wallis (U. S. Naval Research Lab., Washington, D. C.) and Robert Herman and Harold Willis Milnes (General Motors Corp., Warren, Mich.). J. Mol. Spectroscopy 4, 51-74(1960) Jan. (In English)

A quantum mechanical investigation was made of the energy levels of an electron moving in the field of two fixed charges with values +e and −e and having a separation R.

The Schrödinger equation for this problem is separable in confocal elliptic coordinates. The evaluation of the energy eigenvalues requires the solution of two simultaneous transcendental equations involving continued fractions. The solutions of these transcendental equations were worked out for the ten lowest bound states over a range of values of R using an IBM 704 electronic computer. The binding energy of the electron decreases monotonically as R decreases for all states considered. For a given state the electronic binding energy is very small for values of R less than the Bohr radius of the corresponding hydrogenic state obtained by letting $R \to \infty$. Applications of the results to color center problems and to other solid state physics problems are discussed. (auth)

6862

ON THE PARITY OF K-BARYON VERTICES. D. Kleitman (Universitetes Institut for Teoretisk Fysik, Copenhagen). Nuclear Phys. 14, 33-41(1959) Dec. (1). (In English)

The baryon mass spectrum is examined for a set of theories in which π mesonic interactions are universal and K mesonic interactions distinguish between nucleons and cascade particles only through their having opposite space inversion properties. The nucleon-cascade particle mass splittings for such theories are evaluated through use of the approximations that vertex corrections in the mass operator may be ignored, and that only the leading divergent terms in the mass renormalization need be considered. It is shown that this splitting only has the correct sign if nucleon-K meson vertices are scalar rather than pseudoscalar. (auth)

6863

A CONTRACTION RULE FOR COMPOSITE PARTICLES. R. Blankenbecler (Princeton Univ., N. J.). Nuclear Phys. 14, 97-105(1959) Dec. (1). (In English)

A contraction rule for an arbitrary composite particle is derived, based on results due to Nishijima, and Klein and Zemach. The relation between this contraction rule and the analogous problem in potential scattering is demonstrated by an explicit reduction to the nonrelativistic limit. Applications of these rules are briefly discussed. (auth)

6864

THE UNIVERSAL FERMI INTERACTION AND HEAVY MESONS. Seitaro Nakamura (Centre d'Études Nucléaires, Saclay, France). Nuclear Phys. 14, 155-68(1959) Dec. (1). (In English)

By postulating interchangeability of the fermions, forty-four kinds of new heavy bosons are introduced which were not included in the Gell-Mann-Nishijima scheme. These bosons aid in interpreting β-decay and other processes by the universal Fermi interaction in terms of the competitive processes involving the intermediary of boson groups. The existence of new kinds of muons with extraordinary long life-times of 1 to 100 days is also conjectured. (auth)

6865

A METHOD OF ANALYSIS OF EVENTS INVOLVING MULTIPLE MESON PRODUCTION. H. Huzita (Univ. of Wisconsin, Madison). Nuovo cimento (10) 14, 484-92(1959) Nov. 1. (In English)

A method is proposed for evaluating the primary energy in events which lead to multiple meson production. The method utilizes both the energies and angles of the secondary particles to determine the primary energy and assumes β (in the equation $p_c\beta c = E_c$ where c denotes quantities in the center-of-mass system) to be the velocity of the particle in the center-of-mass system. A term is introduced which makes differentiation of K mesons and π mesons possible at large angles. The term is proportional to the square of the mass of the secondary particle and is of the same order of magnitude as the term containing the square of the angle. Events published previously were analyzed by the method and the results compared with theories. (C.J.G.)

6866

THE NATURE OF THE NEUTRAL PARTICLES EMITTED IN $K_{\beta 3}$ DECAY. K. Imaeda and M. A. Shaukat (Dublin Inst. for Advanced Studies). Nuovo cimento (10) 14, 493-8(1959) Nov. 1. (In English)

An event was observed in photographic emulsion in which a K^+-meson appears to decay at rest to a positron and a Dalitz electron-pair. The results of dynamical analysis, coupled with considerations of conservation of spin are interpreted as providing direct evidence for the emission of π^0 in $K_{\beta 3}$ decay.

6867

ON THE PIONIC DECAY OF THE Λ-PARTICLE. L. Tenaglia (Università, Bari, Italy). Nuovo cimento (10) 14, 499-508(1959) Nov. 1. (In English)

On the hypothesis that the pionic decay of the Λ-particle is due to a Fermi interaction, the corrections to the axial and vector coupling constants are evaluated by the Goldberger and Treiman procedure. Due to the fact that only the intermediate nucleon-antinucleon states give appreciable contribution to the corrections, their evaluation depends on the complex phase shifts of the nucleon-antinucleon scattering. Such phase shifts are not known well enough to be able to derive from them good information on the pionic Λ-decay; therefore the well known corrections to the axial coupling constant in the decay of the pion ($\pi \to \mu\nu$) are explicitly referred to. This comparison allows quantitative application of the procedure to the decay $\Lambda \to p\pi^-$ with satisfactory results. It is also possible to verify that the constants in the decay hamiltonian of the Λ are strongly modified when the possible corrections to the Fermi interactions among bare particles (virtual emission of pions by the Λ-particle and reabsorption by the Λ or by the nucleon in the final state) are taken into account. With the given procedure, one has to assume that the Fermi interaction operates among dressed spinors. (auth)

6868

A MANDELSTAM REPRESENTATION IN POTENTIAL SCATTERING. J. Bowcock and A. Martin (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 516-26(1959) Nov. 1.

The scattering from a given class of potentials including exchange forces is considered. For fixed energy it is proved that the scattering amplitude is analytic in the complex $\cos\theta$ plane inside the Lehmann ellipse and that each term of the Born series has the cuts and analytic behavior conjectured by Mandelstam for the field theoretical case. A Mandelstam representation is written for each term of the Born series. (auth)

6869

ON SCALE TRANSFORMATIONS. J. Wess (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 527-31(1959) Nov. 1. (In English)

Invariance against scale transformation was used by W. Heisenberg to define a lepton number. Some properties of this transformation are more easily investigated with scalar fields, the mass dependence of which is known. For the scalar fields and the harmonic-oscillator,

some properties of the infinitesimal transformation are listed.

6870

ABSORPTIONS OF K^- MESONS AT REST IN LIGHT AND HEAVY NUCLEI OF THE EMULSION. C. Grote, I. Hauser, U. Kundt, U. Krecker, K. Lanius, K. Lewin, and H. W. Meier (Deutsche Akademie der Wissenschaften, Berlin and Kernphysikalisches Institut, Berlin). Nuovo cimento (10) 14, 532-9(1959) Nov. 1. (In English)

1000 K^- captures at rest were analyzed in an emulsion stack exposed to the Berkeley Bevatron. In (38.4 ± 2)% of the events, pions were emitted. The K^- captures were separated into those involving the light and those involving the heavy nuclei of the emulsion. It was observed that 25% of the events were captured in light nuclei. (auth)

6871

THE FIELD THEORETIC DEFINITION OF THE NUCLEAR POTENTIAL. [PART] I. J. M. Charap and S. P. Fubini (European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 540-59(1959) Nov. 1. (In English)

It is shown that the static limit ($\mu/M \to 0$) leads to completely unreliable results in a perturbation theory definition of the potential, even in graphs without elastic scattering intermediate states. It is possible to define a potential which is an energy-independent function of r alone, which when inserted into a non-relativistic Schrödinger equation reproduces the relativistic field-theoretic scattering matrix at sufficiently low energies. A method is developed whereby such a potential, in which both μ and M occur as parameters, is defined unambiguously for the case of a proton and a neutron scattering through a neutral meson field. By using dispersion relations for proton-neutron scattering, it is concluded that the potential reproduces the scattering matrix for momenta $\ll \sqrt{M\mu}$. Finally, a general method for explicit construction of the potential as a superposition of Yukawa potentials of different masses is proposed, and the one- and two-meson exchange contributions to the potential are evaluated. (auth)

6872

ON THE COUPLING OF THE ELEMENTARY PARTICLES WITH THE ELECTROMAGNETIC FIELD. C. G. Bollini (Imperial Coll., London). Nuovo cimento (10) 14, 560-70 (1959) Nov. 1. (In English)

A theory on the coupling of elementary particles with the electromagnetic field is presented. All the supplementary conditions are considered as constraint equations imposed on the wave function and it is implied that only $2s + 1$ (s = spin) of its components are really independent. In the free field case, all the elementary particles obey the Klein-Gordon equation of motion. To introduce the electromagnetic field in a general way a basic interaction involving the transformation matrix of the wave function is considered. A process is described, by means of which a gauge invariant equation of motion can be constructed. The theory is renormalizable and describes particles having the normal gyromagnetic factor 2 for any spin value. (auth)

6873

ON THE PHASE FACTORS IN INVERSIONS. G. Feinberg (Brookhaven National Lab., Upton, N. Y.) and S. Weinberg (Columbia Univ., New York). Nuovo cimento (10) 14, 571-92(1959) Nov. 1. (In English)

The phase factors which can appear in the definition of the inversions, C, P, T, and their products are discussed. It is shown that because of the existence of "physically equivalent" Hamiltonians, the phases in C, CP, T, and TP for complex fields are unmeasurable. For the remaining inversions, it is possible to construct interactions which require more general phases for complex fields than the usual ±1 and ±i, when and only when the theory contains certain discrete multiplicative symmetries. Examples of such interactions are given. (auth)

6874

ON THE VALIDITY OF THE EXPONENTIAL LAW FOR THE DECAY OF AN UNSTABLE PARTICLE. M. Lévy (Université, Paris). Nuovo cimento (10) 14, 612-24(1959) Nov. 1. (In English)

The departure from the exponential decay law of an unstable particle is discussed, starting from an initial state which is a general superposition of eigenstates of the Hamiltonian. By utilizing the Lee model, it is shown that the asymptotic behavior and the magnitude of the additional terms are strongly affected by the production mechanism. Although they can never vanish exactly, these terms can be made arbitrarily small by an appropriate preparation of the initial state. A possible generalization of this result is discussed. (auth)

6875

K^--NUCLEON SCATTERING LENGTHS AND THE K^--d SCATTERING REACTIONS. T. B. Day, G. A. Snow, and J. Sucher (Univ. of Maryland, College Park). Nuovo cimento (10) 14, 637-52(1959) Nov. 1. (In English)

The K^--d elastic and total cross sections are calculated, using a model which includes multiple scattering effects. The scattering lengths which Dalitz and Tuan find as fits to the K^--p data are used in an attempt to distinguish between the four possibilities. The impulse approximation fails to give sensible results in this problem. (auth)

6876

ON THE INTERACTIONS OF THE NUCLEONS. L. Tenaglia (Università, Bari, Italy). Nuovo cimento (10) 14, 653-5(1959) Nov. 1. (In English)

The formalism of Dallaporta and Toyoda is used to formulate the Dirac equation for the nucleon field (n = 1). The electromagnetic interaction of the baryons is compared to the pion and Fermi interaction of the nucleons. (C.J.G.)

6877

THE MULTIPLE PRODUCTION OF PARTICLES IN (pp)- AND ($p\pi^-$)-COLLISIONS AT ENERGIES OF (1 + 10) GeV. V. S. Barašenkov (Joint Inst. for Nuclear Research, Dubna, USSR). Nuovo cimento (10) 14, 656-8(1959) Nov. 1. (In English)

The calculated probabilities W_n of 2-, 4-, and 6-prong star production and the calculated number of charged particles $\bar{n}$, produced in (π^--p) and (p-p) reactions, are given. The interaction between the created π mesons and the nucleons was taken into account. (C.J.G.)

6878

K^+-DEUTERIUM INELASTIC AND EXCHANGE SCATTERING. [PART] II. M. Gourdin (Ecole Normale Supérieure, Paris and Faculté de Sciences, Bordeaux) and A. Martin (Ecole Normale Supérieure, Paris and European Council for Nuclear Research, Geneva). Nuovo cimento (10) 14, 721-34(1959) Nov. 16. (In English)

Gourdin and Martin studied (K^+,d) elastic and inelastic scattering reactions using impulse approximation and neglecting the final state interaction of the nucleons. Computations on exchange differential, elastic differential, and total cross sections are improved by taking into account the final state interaction of the nucleons, all other assump-

tions being maintained. The Coulomb interaction of the p – p system in the case of exchange scattering, the D state in the deuteron, and the $K^0 - K^+$ mass difference are neglected. (C.J.G.)

6879

NON-LOCAL EFFECTS IN ELECTRON-ELECTRON AND ELECTRON-POSITRON SCATTERING. G. Furlan and G. Peressutti (Istituto Nazionale di Fisica Nucleare, Trieste, Italy and Università, Trieste, Italy). Nuovo cimento (10) 14, 758-66(1959) Nov. 16. (In English)

The effect of a modification of the Coulomb law at small distances on the cross sections for electron-electron and electron-positron scattering is calculated. A detailed analysis shows that the Møller cross section is less sensitive to non-local effects than the Bhabha cross section. (auth)

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The interaction of π^+ mesons with protons at an energy of 500 Mev was studied in a hydrogen bubble chamber. Phase-shift analyses with S and P waves were made, and a near degeneracy was found between the Fermi and Yang solutions. When D waves were included, an additional ambiguity was found. The D-wave phase shifts are small but they have a considerable effect on the other phase shifts. The cross section for single pion production is 2.85 ± 0.5 mb. The ratio (p + 0)/(n++) is $1.5^{+1}_{-.5}$. The cross section leading to p++− was found to be of the order of 30 μb. (auth)

6895

PANOFSKY RATIO FOR NEGATIVE PIONS ABSORBED IN HYDROGEN. E. L. Koller and A. M. Sachs (Columbia Univ., New York). Phys. Rev. 116, 760-8(1959) Nov. 1.

The ratio of mesonic to radiative capture of stopped negative pions in hydrogen, i.e., the Panofsky ratio, provides a useful link in analyzing the results of photoproduction of pions and pion-nucleon scattering. Previous measurements of the Panofsky ratio indicate possible

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6894

π^+-p INTERACTIONS AT 500 MEV. William J. Willis (Yale Univ., New Haven and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 753-9(1959) Nov. 1.

The interaction of π^+ mesons with protons at an energy of 500 Mev was studied in a hydrogen bubble chamber. Phase-shift analyses with S and P waves were made, and a near degeneracy was found between the Fermi and Yang solutions. When D waves were included, an additional ambiguity was found. The D-wave phase shifts are small but they have a considerable effect on the other phase shifts. The cross section for single pion production is 2.85 ± 0.5 mb. The ratio (p + 0)/(n++) is $1.5^{+\frac{1}{4}}_{-\frac{1}{3}}$. The cross section leading to p++– was found to be of the order of 30 μb. (auth)

6895

PANOFSKY RATIO FOR NEGATIVE PIONS ABSORBED IN HYDROGEN. E. L. Koller and A. M. Sachs (Columbia Univ., New York). Phys. Rev. 116, 760-8(1959) Nov. 1.

The ratio of mesonic to radiative capture of stopped negative pions in hydrogen, i.e., the Panofsky ratio, provides a useful link in analyzing the results of photoproduction of pions and pion-nucleon scattering. Previous measurements of the Panofsky ratio indicate possible

systematic errors in the experimental techniques. The ratio was measured using (a) a lead glass Čerenkov counter of improved resolution to measure the total energy of the gamma rays (±16% for the 129-Mev gamma rays measured in this experiment), (b) time-of-flight measurement of the 180 degree recoil neutrons to determine the shape of the pulse-height spectrum of the high-energy gamma ray, and (c) a collimator of variable dimensions to test the possible effect of degradation of the high-energy gamma rays in the collimator. The value obtained for the ratio is 1.46 ± 0.10, in good agreement with the Liverpool experiments. (auth)

6896

METHOD FOR THE DETERMINATION OF STRANGE PARTICLE PARITIES AND COUPLING CONSTANTS. John G. Taylor (Christ's Coll., Cambridge, Eng.). Phys. Rev. 116, 768-73(1959) Nov. 1.

A general method for determining parities and coupling constants of strange particles directly from angular distributions is described. A reasonably detailed discussion is given of what can be gleaned by this method from the processes of associated production by photons on nucleons and by pions on protons, and from the absorption and charge exchange scattering of charged K mesons on nucleons. If the relative parity of K^+ to K^0 is odd then strange particle parities may be obtained from all these processes, while if this relative parity is even only photoproduction processes may be used to determine parities. Once these relative parities are determined then coupling constants may be obtained from all the processes. (auth)

6897

ANALYTIC PROPERTIES OF PARTIAL AMPLITUDES IN MESON-NUCLEON SCATTERING. S. W. MacDowell (Univ. of Birmingham, Eng.). Phys. Rev. 116, 774-8 (1959) Nov. 1.

The analytic properties of partial wave amplitudes in meson-nucleon scattering are investigated on the basis of the Mandelstam representation and an integral representation is set up for them which explicitly exhibits those properties. (auth)

6898

CONTRIBUTION OF NUCLEON CURRENTS TO RADIATIVE MUON CAPTURE BY A PROTON. G. K. Manacher and L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 116, 782-4(1959) Nov. 1.

The observables for the reaction $\mu^- + p \rightarrow n + \nu + \gamma$ are calculated for a general $(pn\mu\nu)$ coupling including all terms of order (μ/M) and leading terms of order $(\mu/M)^2$, where μ is the meson mass and M the nucleon mass. The nucleon anomalous magnetic moments are handled by the inclusion of a simple Pauli term and all other virtual pion effects are omitted here. The (μ/M) terms change the radiative capture rate by as much as 30%. Parity-nonconserving effects are decreased only slightly. (auth)

6899

INVARIANT IMBEDDING AND NEUTRON TRANSPORT IN A ROD OF CHANGING LENGTH. Richard Bellman, Robert Kalaba, and G. Milton Wing (RAND Corp., Santa Monica, Calif. and Sandia Corp., Albuquerque, N. Mex.). Proc. Natl. Acad. Sci. U. S. 46, 128-30(1960) Jan.

The method of invariant imbedding was used to investigate neutron behavior in fixed media. Equations are formulated for the case in which the region changes in length as the neutron process continues. (B.O.G.)

6900

COMPLEX EIGENVALUES IN SCATTERING THEORY. R. E. Peierls (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London), A 253, 16-36(1959) Nov. 17.

The non-relativistic problem of scattering of a particle by a target possessing discrete excited states can be expressed in terms of 'physical' resonance states, i.e., solutions of the wave equation for complex energy in which in the asymptotic form of the wave function in each channel one of the two possible exponential terms (which for real energy represent the incoming and outgoing wave) vanishes. This representation is possible provided the interaction between the particles and the target vanishes exactly beyond a certain distance. If the interaction decreases exponentially a similar representation may in some cases still be obtained by analytic continuation; it contains also 'redundant' eigenstates in which the coefficient of one of the asymptotic waves tends to infinity. Possible generalizations of the method are discussed. (auth)

6901

SECOND BORN APPROXIMATION TO THE BREMSSTRAHLUNG DIFFERENTIAL CROSS-SECTION. C. Kacser (Clarendon Lab., Oxford). Proc. Roy. Soc. (London), A 253, 103-20(1959) Nov. 17.

Calculations are made for the second Born approximation contribution to the Bremsstrahlung cross-section differential in both the photon and electron angles. This is divergent if a Coulomb potential is considered, but it is found, on following the idea of Dalitz (1951), that all observable quantities turn out to be finite when we perform the calculation for a Yukawa potential and take the limit of zero screening. It is shown that this is true to order Z^3 in the differential cross-section before it is averaged over spins, and the cross-section is calculated explicitly for the case of an unpolarized beam when the final states of polarization are not observed. Further, it is pointed out that the same methods can be applied satisfactorily in the case of pair production. (auth)

6902

ON RADIATION OF A POINT SOURCE OF ELECTROMAGNETIC WAVES IN GYROMAGNETIC MEDIUM WITH A BOUNDARY SURFACE. K. A. Barsukov (Lebedev Inst. of Physics, Moscow). Radiotekh. i Elektron, 4, 1759-64 (1959) Nov. (In Russian)

6903

THE TEMPERATURE FACTOR FOR SCATTERING OF X-RAY BEAMS IN ROCK SALT CRYSTAL. A. M. Ratner (Inst. of Chemical Reagents, Kharkov). Soviet Phys.-Cryst. 3, 744-6(1960) Jan.

The calculation of the mean square displacement of the sodium and chlorine ions from the equilibrium position at $40°K \geq T \geq 90°K$ in a rock salt crystal is described. (C.J.G.)

6904

MOTION OF ELECTROMAGNETIC WAVES IN THE BRAUNBEK APPROXIMATION. [PART] I. Wilhelm E. Frahn (Council for Scientific and Industrial Research, Pretoria). Z. Physik 156, 78-98(1959). (In German)

An approximation method proposed by Braunbek for the diffraction of scalar waves by plane obstacles, or apertures in a plane screen, is extended to the diffraction of electromagnetic waves. As an example, the diffraction of a linearly polarized plane electromagnetic wave normally incident on a circular aperture in a perfectly conducting plane screen and on a perfectly conducting plane circular

disk is considered in detail. The results are compared with those obtained from the exact solution of Meixner and Andrejewski and with the results of Kirchhoff's approximations. It is shown that, in contrast to the Kirchhoff approximations, Braunbek's method leads in all cases to the correct 'optical' limits and represents a good approximation even for wavelengths comparable with the size of the obstacle. After a general formulation of Braunbek's method in the electromagnetic diffraction problem, the far field of the circular aperture and the transmission coefficient by means of the cross section theorem are calculated. The near field of the circular aperture and the circular disk will be considered in a subsequent paper. (auth)

6905

MOTION OF ELECTROMAGNETIC WAVES IN THE BRAUNBEK APPROXIMATION. [PART] II. Wilhelm E. Frahn (Council for Scientific and Industrial Research, Pretoria). Z. Physik 156, 99-116(1959). (In German)

The extension, given in a previous paper (Z. Physik 156, 78(1959)), of Braunbek's approximation method to the diffraction of electromagnetic waves, is applied to the near field of the circular aperture and the circular disk. The field distributions along the central axis and in the plane of the screen are calculated and compared with the results of both the rigorous solution and Kirchhoff's approximation. The relation of Braunbek's method to other approximation methods for the optical region is discussed. (auth)

6906

AN INVESTIGATION OF THE ELECTRON COMPONENT OF ELECTRON AVALANCHES. L. Frommhold (Universität, Hamburg). Z. Physik 156, 144-58(1959). (In German)

The oscilloscopic study of pulses due to the electron component of avalanches in homogeneous fields confirms that the number of electrons increases exponentially with time. Measuring drift velocity v_- and applying recent measurements of the first Townsend coefficient α, the time constant τ was found to be equal to $1/\alpha \cdot v_-$ as was expected. The axial diffusion radius of the electron swarm and thus the mean energy of agitation (0.4 to 0.7 ev) and the cross section for electron impact are obtained. Space charge influence becomes apparent with carrier numbers of about 10^7 electrons, attenuating the temporal rate of further growth of the avalanche. This is in accordance with earlier work on avalanches. The investigation was made with methane in the range of E/p from 28 to 58 V/cm · mm Hg, with pd-values from 50 to 1500 cm · mm Hg, with mean gas amplification from e^{12} to e^{17}, and with gap widths of 2, 3, and 6 cm. (auth)

6907

THE ADDITIVITY OF PHOTOELECTRIC CURRENT AND SECONDARY ELECTRON CURRENT. E. Brinkmann and H. Deichsel (Universität, Mainz). Z. Physik 156, 159-62 (1959). (In German)

Papers from Ekertowa and Dember show contradicting results concerning the additivity of photoelectric current and secondary electron current. Upon investigation it was found that additivity exists between photoelectric current and secondary electron current for metals in agreement with Ekertowa. The large departures from additivity, observed by Dember, receive reasonable interpretation in terms of an internal photoelectric effect in the oxide layer of his target. (auth)

6908

MULTIPLE SCATTERING OF ELECTRONS AT LARGE ANGLES. I. SOLUTIONS FOR INFINITE EXPANDING MEDIUM. Gert Moliere (European Council for Nuclear Research, Geneva). Z. Physik 156, 318-47(1959). (In German)

It is shown that the spatial solutions of the Boltzmann integral differential (transport) equation, which are dependent on a single coördinate x, are of the same general form as those found by Bethe, Rose, and Smith for the case of diffusion differential equations, i.e., apart from a particular solution linear in x and μ (= cos φ) an infinite system of linear independent solution of the form $\phi_n^{(m)}$ ($\pm\mu$)cos (mα) exp ($\pm k_n^{(m)}$ x), where α is the azimuth, is obtained. The $\phi_n^{(m)}$ (μ) forms no usual orthogonal system, but are "orthogonal with a weight μ". This peculiarity leads to a special spherical harmonic development $\phi_n^{(m)}$ ($\pm\mu$) = $\Sigma(\pm a_{n,\nu}^{(m)} + b_{n,\nu}^{(m)}/\mu)P_{2\nu+m+1}^{m}(\mu)$, in which only the uneven spherical harmonics correlated in μ were used. The development coefficient of $\phi_n^{(m)}$ (μ) and the appropriate eigenvalues $k_n^{(m)}$ lead to an infinite scalar problem from which a convenient and very accurate numerical solution method is constructed. The method includes as a special case the diffusion differential equation treated by Bothe and Bethe and by Rose and Smith, which serves as one of the first numerical application examples. The results were used to construct solutions which satisfy the boundary conditions of the plane-parallel plate for perpendicular and sloping incidence of the primary beam. In the latter case the $\phi_n^{(m)}$ (μ) appropriate for m ≠ 0 must be used. (tr-auth)

6909

DERIVATION OF THE BINDING ENERGY FOR N-PARTICLE SYSTEMS FROM 2-PARTICLE DENSITY MATRICES. Fritz Bopp (Universität, Munich). Z. Physik 156, 348-59(1959). (In German)

When three and multi-body forces are missing, the energy of a multi-particle system is determined rigorously from a density matrix $\langle 1\ 2|\rho|1'\ 2'\rangle$ for two particles. This can be calculated almost alone from the eigen solutions of the "correlated two-particle problem" with the hamilton operator $h = H_1 + H_2 + (N-1)H_{1\,2}$. If ϕ_n is its eigenfunction and ϵ_n the appropriate eigenvalue of h, the density matrix is $\langle 1\ 2\,|\,\rho\,|1'\ 2'\rangle = \Sigma p_n \phi_n(1\ 2)\ \phi_n^*(1'\ 2')$, and the energy is $E = N/2\ \Sigma p_n \epsilon_n$. For the weights p_n (> 0 with $\Sigma p_n = 1$) a rigorously valid equation was given. In the zero approximation $p_n = 2/(N(N\ 1))$ for the lowest eigenvalues and p_n = 0 for the usual eigenvalues. In atoms this approximation is of the validity of the Hartree-Fock approximation at least and yields a lower range for the actual eigenvalues, as is shown in examples. (tr-auth)

6910

SUPPLEMENT TO SOMMERFELD'S THEORY FOR X-RAY BREMSSTRAHLUNG. H. Kulenkampff, M. Scheer, and E. Zeitler (Universität, Würzburg, Ger.). Z. Physik 157, 275-81(1959) Nov. (In German)

The final formula of the Sommerfeld theory of bremsstrahlung of 1931 gives for emission directions of $\theta = 0$ and 180° a polarization P > 0 whereas from the base of symmetry P must be equal to zero; the formula therefore also does not give the angular distribution of intensity correctly. This can be corrected by another distribution of single terms on the y or z component (x direction = perpendicular to the electrons). New experimental results are presented which show that the angle $\theta = 90°$ in the general case is displaced by an angle θ^* which is defined by $\cos\theta^* = \beta_0$ (= v_0/c; V_0 = initial velocity of electron). Accordingly, it is shown how the Sommerfeld formula can be informally supplemented. Further consideration leads to a presentation from which it can be expected that even

for average values of β_0 a good approximation obtains. The angle θ^* retains its special significance to the highest, extremely relativistic energies. The Sommerfeld-Schiff formula is briefly discussed. (tr-auth)

6911

A SIMPLE DERIVATION FOR THE ADVANCE OF THE INTENSITY MAXIMA OF X-RAY BREMSSTRAHLUNG. H. Kulenkampff (Universität, Würzburg, Ger.). Z. Physik 157, 282-5(1959) Nov. (In German)

The advance of the intensity maxima of x-ray bremsstrahlung can be clearly described if one considers the emission of quanta first in a reference system with the electrons in relative motion and then in a static reference system. From this accurate qualitative description a correct formula for the angular distribution of radiation intensity results. In addition it is pointed out that only in the relative motion reference system does the Doppler effect appear, and in the static system only the advance, without the Doppler effect appears. (tr-auth)

6912

THE COMPATIBILITY OF A DISPERSION RELATION FOR PION-NUCLEON SCATTERING WITH EXPERIMENTAL DATA. K. Dietz and G. Höhler (Universität, Munich). Z. Physik 157, 362-8(1959) Nov.

The dispersion relation for the 3-3-amplitude given by Chew, Goldberger, Low, and Nambu cannot be tested presently because of the experimental uncertainties of the scattering phase, but it discriminates between several interpolations of the experimental data. The only conclusion which can be drawn from the discrepancy found by Tsuchida and Kanazawa is that the Breit-Wigner formula is not suitable. We have shown that the experimental values are consistent with the dispersion relation if an effective range formula is used up to 120 Mev. The result for the coupling constant $f^2 = 0.097$ is somewhat higher than the value used in the effective range formula, but the difference is probably not larger than the terms which are neglected in the derivation of the dispersion relation. (auth)

6913

VERIFICATION OF PARITY CONSERVATION IN STRONG INTERACTIONS BY $\beta-\alpha$ ANGULAR CORRELATION AND $\alpha-\alpha$ CORRELATION. Lorenz Krüger (Universität, Heidelberg, Ger.). Z. Physik 157, 369-83(1959) Nov. (In German)

It is shown that beta-gamma directional correlations provide a means to test parity conservation in the nucleon-nucleon-interaction. A parity nonconservation would lead to an asymmetry of the correlation relative to 90° and proportional to RF in magnitude. In this product F signifies the relative amplitude of the wave function of 'wrong' parity in a nuclear state and R a matrix element factor. Some examples are discussed numerically; estimates of an upper limit for F^2 of about 10^{-8} seem possible in suitable experimental cases. The use of gamma-circular gamma-correlations as a means of testing parity conservation in nuclear states is briefly reviewed. (auth)

6914

MULTI-QUANTUM TRANSITIONS OF PROTONS. S. Wilking (Technische Hochschule, Karlsruhe, Ger.). Z. Physik 157 401-6(1959) Nov. (In German)

In addition to the photon-Larmor-resonance frequency, resonances of the condition $n\,\omega = \gamma H_0$ (n is a whole number) up to n = 18 were observed in water. These resonances were interpreted as multi-quantum transitions. From this the energy difference between the only energy states E $(+\frac{1}{2})$ and E $(-\frac{1}{2})$ of n photons is produced, which the rotation impulse component is partially compensated. The transition probabilities were measured. Their maximum values are, in contrast to single-quantum resonance transitions, field-dependent and decrease faster with decreasing resonance field strength as more photons are involved in a transition. (tr-auth)

6915

POLARIZATION OF NEUTRONS FROM THE T(p, n)He^3 REACTION AND PROTONS FROM THE He^3(n, p)T REACTION. K. P. Artemov, N. A. Vlasov, and L. N. Samoilov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1183-6(1959) Nov. (In Russian)

Polarization of neutrons produced in the T(p,n)He^3 reaction by 8 to 10 Mev protons was determined by measuring the right-left asymmetry of protons produced in the inverse reaction He^3(n,p)T. The dependence of the asymmetry on the angle of emission of the proton from the He^3(n,p)T reaction was also measured. Polarization of the T(p,n)He^3 neutrons and He^3(n,p)T protons reaches 30% for an angle of incidence of about 40° and primary proton energy of approximately 10 Mev. With decrease of proton energy the polarization decreases, but the angle of emission corresponding to peak polarization does not change appreciably. (auth)

6916

INTERACTION OF 9 Bev PROTONS WITH FREE AND QUASIFREE NUCLEONS IN PHOTOGRAPHIC EMULSIONS. N. P. Bogachev, S. A. Bunyatov, I. M. Gramenitskii, V. B. Lyubimov, Yu. P. Merekov, M. I. Podgoretskii, V. M. Sidorov, and D. Tuvdendorzh (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1225-32(1959) Nov. (In Russian)

The problem of the angular and energy characteristics of secondary particles produced in the collisions between protons and nucleons is considered. (auth)

6917

DISTRIBUTION OF THE DENSITY OF PROTONS IN A NUCLEUS WITH A GIVEN ANGULAR MOMENTUM. L. P. Rapoport and S. G. Cadmenskii (Voronezh State Univ., USSR). Zhur. Eksptl'. i Teoret Fiz. 37, 1303-7 (1959) Nov. (In Russian)

The density of protons in a nucleus possessing a given angular momentum $\rho_l(r)$ is computed on basis of the experimental distribution of the total proton density $\rho(r)$. Spatial separation of nuclear shells is demonstrated by means of the distribution thus obtained. (auth)

6918

ON THE ANOMALOUS MAGNETIC MOMENT OF NUCLEONS IN CHEW'S METHOD. Yu. M. Lomsadze, V. I. Lend'el, and B. M. Ernst (Uzhgorod State Univ., USSR). Zhur. Eksptl'. i Tepret. Fiz. 37, 1342-5(1959) Nov. (In Russian)

Corrected values of nucleon magnetic moments due to π meson and nucleon virtual currents were obtained by Chew's method. Consideration of the contribution of strange particles and of the hypothetical ρ^0 meson is made under various assumptions regarding their intrinsic parities. (auth)

6919

FIELD OF A CHARGED PARTICLE IN A MOVING MEDIUM. B. M. Bolotovskii and A. A. Rukhadze (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 37, 1346-51(1959) Nov. (In Russian)

The field produced by a charge passing through a moving medium is considered. Energy losses due to emission of

Cherenkov-Vavilov radiation and excitation of plasma waves are determined. (auth)

6920

ON A CERTAIN POSSIBILITY OF INVESTIGATION OF THE STRUCTURE OF NUCLEONS AND NUCLEI. N. G. Birger and Yu. A. Smorodin (Lebedev Inst. of Physics, Moscow). Zhur. Ekaptl'. i Teoret Fiz. 37, 1355-60 (1959) Nov. (In Russian)

It is shown that in the interaction of high energy particles the sum of the quantities $(E-\rho\cos\vartheta)$ for all particles emitted after the interaction is equal to the mass of the target particle which effectively participates in the interaction. Thus the distribution of $\Sigma(E-\rho\cos\vartheta)$ is specified by the structure of the target particle. Application of this type of analysis to the experimental data on nucleon-nucleon interactions shows that interactions with the part of the target possessing mass close to that of the π meson are dominant. (auth)

6921

INELASTIC COLLISIONS BETWEEN FAST POLARIZED PARTICLES AND ATOMS. V. V. Batygin and I. N. Toptygin (Leningrad Polytechnic Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1372-8(1959) Nov. (In Russian)

The differential cross section for scattering of electrons, positrons, and μ mesons on atoms was derived in the Born approximation as a function of the polarization of the particles in the initial and final states. The change in the polarization vector which occurs when the particles are scattered on free unpolarized electrons is also determined. (auth)

6922

DISPERSION RELATIONS FOR INELASTIC PROCESSES INVOLVING K MESONS. Yu. Vol'f (J. Wolf) (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1379-84(1959) Nov. (In Russian)

Dispersion relations for processes of the $K + N \rightarrow Y + \pi$ type are presented. The intermediate state spectrum is investigated. The structure of the amplitude for scalar and pseudoscalar K mesons is given. (auth)

6923

REDUCED WIDTHS FOR NUCLEON ASSOCIATIONS IN THE SHELL MODEL OF THE NUCLEUS. V. V. Balashov, V. G. Neudachin, Yu. F. Smirnov, and N. P. Yudin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1385-9(1959) Nov. (In Russian)

A method is considered which can be employed to calculate the reduced widths for compound nucleus level decay involving the emission of deuterons, tritons, and α particles. The analysis is based on the shell model of the nucleus. (auth)

6924

VELOCITY DISTRIBUTION OF ELECTRONS IN A STRONG ELECTRIC FIELD. L. M. Kovrizhnykh. Zhur. Eksptl'. i Teoret. Fiz. 37, 1394-1400(1959) Nov. (In Russian)

A method is developed for determination of a nonstationary solution of the Boltzmann equation in the case of strong electric fields. An expression is derived for the electron distribution function in a completely ionized plasma located in a strong electric field. It is shown that in a first approximation the distribution is a Maxwellian one superimposed on the general translational motion of the electron gas. In a first approximation the translational velocity increases proportionally with time whereas the temperature remains constant. (auth)

6925

ON A CERTAIN POSSIBILITY OF SETTING UP A SYSTEM "ELEMENTARY" PARTICLES. I. V. Chuvilo (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1401-6(1959) Nov. (In Russian)

The possibility of setting up a system of baryons and mesons based on the requirement of the existence of a single "elementary" baryon and a single "elementary" meson and of a strong interaction between them is considered. The "elementary" particles chosen are the singlet baryon Ω^- with a strangeness of -3 and the isotopic doublet of K^+, K^0 mesons with a strangeness $+1$. Some of the conclusions arrived at qualitatively agree with well known experimental data on processes involving "strange particles". Some qualitative results relating to nucleon form factors are obtained. (auth)

6926

CONTRIBUTION OF THREE-PARTICLE FORCES TO THE BINDING ENERGY OF HYPER-NUCLEI. V. A. Lyul'ka and V. A. Filimonov (Moscow State Univ. and Tomsk Polytechnic Inst., USSR). Zhur. Eksptl'. i Teoret Fiz. 37, 1431-3(1959) Nov. (In Russian)

The three-particle Λ-nucleon potential is computed in the lowest order in meson theory. It is shown that in hypernuclei the contribution of the calculated potential to the Λ-particle energy is positive and insignificant in magnitude. The estimates thus obtained do not confirm Spitzer's conclusion that three-particle forces play a large role in hypernuclei. (auth)

6927

RELATIVISTIC SPHERICAL FUNCTIONS. A. Z. Dolginov and I. N. Toptygin (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1441-51(1959) Nov. (In Russian)

Properties of infinitely dimensional representations of the Lorentz group are considered which are of interest for solution of problems of relativistic elementary particle theory. Infinitely dimensional representations are applied to an analysis of the amplitudes of the $a + b \rightarrow c + d$ reaction. (auth)

6928

ON THE ZONE ENERGY SPECTRUM IN THE PRESENCE OF A MAGNETIC FIELD. G. E. Zil'berman (Kharkov Higher Aviation-Engineering Military Coll.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1452-4(1959) Nov. (In Russian)

Eigenfunctions (in the k representation) are derived which describe the motion of an electron with an arbitrary dispersion law in a magnetic field, with consideration of two zones (and in particular of overlapping ones). The condition of applicability of the one-zone approximation is deduced. (auth)

6929

MEASUREMENTS OF ENERGY LOSS OF FAST ELECTRONS PASSING THROUGH A SUBSTANCE. I. A. Grishaev, A. N. Fisun, A. S. Litvinenko, V. M. Grizhko, B. I. Shramenko, and I. N. Onishchenko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1455-6(1959) Nov. (In Russian)

Experiments for determining the most probable energy losses of 18-Mev electrons are described. Characteristic graphs made with targets of aluminum, polystyrene $(C_8H_8)_n$, and organic glass $(C_4H_8O_2)_n$ are in good agreement with theoretical and published data. (R.V.J.)

6930

THE MOTION OF A CHARGED PARTICLE IN A SPINNING

MAGNETIC FIELD. A. P. Kazantsev (Inst. of Radiophysics and Electronics, Siberian Branch of the Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1463-4 (1959) Nov. (In Russian)

The problem of charged particle localization by alternating electromagnetic fields has been previously discussed in published literature. Data are presented on particle localization by a rotating magnetic field under special conditions. (R.V.J.)

6931

ANGULAR ASYMMETRY IN (π,n) COLLISIONS AND (π,π) INTERACTIONS. V. S. Barashenkov (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1464-6(1959) Nov. (In Russian)

A model of "central" and "peripheral" collisions was developed by I. E. Tamm for experiments with inelastic (N–N) collisions at E > 1 Bev. The model is applied in the investigation of angular distributions of particles produced by inelastic (π-N) collisions. A diagram of central and peripheral (π-N) collisions is plotted. The spin and isotopic spin are considered to be $3/2$; the peripheral collisions are described by π-π interactions. Numerical calculations were made for (π^-, p) collisions are at 5 Bev. The multiple production statistical theory was used in calculations of π-p and π-π collisions. Tabulated data on particle production in peripheral collisions indicate a considerable angular asymmetry. Both models (with the isobar and without) explain qualitatively the experimental magnitude of angular asymmetry; however, the model with the isobar is in better agreement. (R.V.J.)

6932

SCATTERING OF LOW-ENERGY ELECTRONS BY SHORT-RANGE POTENTIAL IN A STRONG MAGNETIC FIELD. V. G. Skobkov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1467-9(1959) Nov. (In Russian)

Scattering of electrons with energy E by the potential V(r) in a homogeneous magnetic field H, considering the range radius of the scattering potential as $E_0 \ll \lambda = (2mE)^{-1/2}$, is analyzed. (R.V.J.)

6933

CAPTURE OF POLARIZED μ-MESONS BY DEUTERONS. A. P. Bukhvostov and I. M. Shmushkevich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1471-3(1959) Nov. (In Russian)

It is postulated that polarized μ meson capture by deuterons is in reality a capture by a polarized nucleus which becomes polarized due to the long μ meson life on the K shell. The capture of μ mesodeuterons is analyzed as capture from states with total moment $F = 3/2$ and $F = 1/2$. (R.V.J.)

6934

ON THE PION AND ELECTROMAGNETIC STRUCTURE OF NUCLEONS. B. B. Dotsenko (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 27, 1478-9(1959) Nov. (In Russian)

The tri-pion state in nucleon electromagnetic structure was analyzed using the phenomenological concepts for describing the tri-pion state. (R.V.J.)

6935

ON THE ANOMALOUS EQUATIONS FOR PARTICLES WITH SPIN 1/2. I. Marek and I. Ulegla (Inst. of Nuclear Physics, Prague). Zhur. Eksptl'. i Teoret. Fiz. 37, 1482-4(1959) Nov. (In Russian)

An attempt is made to show the errors in L. A. Shelepen's (JETP 34, 1574(1958)) postulation about the reducibility of anomalous equations with a single spin 1/2 and several self-masses. (R.V.J.)

6936

THEORETICAL INTERPRETATION OF INELASTIC p-p AND p-n COLLISIONS AT 9 Bev. V. S. Barashenkov, V. A. Mal'tsev, and E. K. Mikhul (Joint Inst. of Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1484-6(1959) Nov. (In Russian)

An optical analysis of n-n collisions at 1 to 9 Bev indicates two types of collisions (collisions between central parts of nucleons and between the periphery of one nucleon and the central part of the other) which differ by the impact parameters $r_0 \sim 0.6 \times 10^{-13}$ cm. The ratios η of the number of particles emitted in p-p collisions at small angles to the number of particles calculated using statistical theory are tabulated. The ratio of the observed number of stars with n-rays (n = 1, 3, 5 for p-n and n = 2, 4, 6 for p-p collisions) to the theoretically calculated N_n^{exp}/N_n^{theor} was found. The mean theoretical multiplicities, $N_{(pp)} = 3.5$ and $N_{(pn)} = 3.2$, only slightly exceed the experimental magnitudes $\bar{n}_{(pp)} = 3.22 \pm 0.12$ and $\bar{n}_{(pn)} = 2.62 \pm 0.13$. The experimental angular distribution averaged at large angles ($\Delta\cos\theta = 0.1$) indicates that central nuclear collisions constitute the main part of N-N collisions. The mean plurality of peripheral collisions is $n_{(pp)} = 3.3$ and $n_{(pn)} = 3.1$. (R.V.J.)

6937

CROSS SECTION OF ELECTRON SCATTERING ON ELECTRONS AT HIGH ENERGIES. V. N. Baier. Zhur. Eksptl'. i Teoret. Fiz. 37, 1490-2(1959) Nov. (In Russian)

A generalized formula was derived for e-e scattering when the electrons are uniformly distributed. Calculations were made for the case of exchange with photons. (R.V.J.)

6938

ON LEPTON MASSES. Yu. A. Gol'fand (Lebedev Inst. of Physics, Moscow). Zhur. Eksptl'. i Teoret. Fiz. 37, 1493-4(1959) Nov. (In Russian)

The mass difference between electrons and μ mesons is analyzed with consideration for certain interactions which are responsible for the "anomalously" small electron mass. The mass of an "interacting" electron as well as the mass of a neutrino is equal to zero and are both symmetric in all interactions. It is postulated that the hypothetical interaction responsible for the small electron mass is also symmetric. The interaction is assumed to be of an exchange type. In order to obtain the electron mass $m_e \sim 1/200\ m_\mu$, the interaction is assumed to have a binding constant of the order $e^2 = 1/137$. It is shown that the correction due to the interaction is disappearingly small in comparison to electromagnetic interactions. The estimate of the interaction's contribution to the anomalous magnetic moment and the shift of electron levels is of the order $(m_e/m_\mu)^2 = 1/4 \times 10^4$ of the main effect. The role of the anomalous μ–e interaction is increased at large energies and can strongly influence the picture of the previously analyzed forces of $e^- + e^+ \rightarrow \mu + \mu^+$. (R.V.J.)

Nuclear Properties and Reactions

6939 AERE-R-2998

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THERMAL NEUTRON FISSION CROSS-SECTIONS OF SEVERAL ISOTOPES. J. F. Raffle. July 1959. 50p. BIS.

A detailed account is given of the measurement of the fission cross sections of U^{233}, U^{235}, Pu^{239}, and Pu^{241} for 2200 m/sec neutrons and for thermal and pile neutron spectra. (auth)

6940 DASA-527

Defense Atomic Support Agency, Washington, D. C.

CRYSTALLINE NUCLEUS. Warren W. Nicholas. June 17, 1959. 39p.

The hypothesis that nuclear protons and neutrons are located on alternate corners of a cubic lattice is found to explain asymmetric fission, spins and magnetic dipole moments of some of the lightest nuclides, certain features of mass defect in light nuclides, and the magic numbers. Several features of the radioactive series are accounted for. Definite structures are proposed for U^{238}, Pb^{208}, and some of the lighter nuclides. (auth)

6941 MLM-747

Mound Lab., Miamisburg, Ohio.

Ac^{227} AND Th^{228} PRODUCTION AS A FUNCTION OF TIME FOR VARIOUS VALUES OF NEUTRON FLUX. (Information Report). G. R. Grove, L. N. Russell, and S. R. Orr. Aug. 28, 1952. Decl. Nov. 24, 1959. 11p. Contract AT-33-1-GEN-53. OTS.

The amount of Ac^{227} per curie of Ra^{226} was calculated for various values of neutron flux and various irradiation times. The amount of Th^{228} produced per curie of Ra^{226} and the percentage of Ac^{227} converted to Th^{228} relative to the total amount of Ac^{227} produced were also calculated. (W.D.M.)

6942 NP-8216

Dewey (G. C.) and Co., Inc., New York.

SELECTED NUCLEAR DATA FOR MONTE CARLO CALCULATIONS. J. R. Lamarsh, A. I. Lieberman, and M. O. Vassell. Oct. 1, 1958. 125p. Contract DA-30-069-501-ORD-2204.

The neutron cross section data currently in use at the Dewey Co. in connection with certain Monte Carlo studies of neutron penetration are summarized. Data are given from 0.025 ev to 14 Mev for H, B, C, N, O, Al, S, Fe, Ba, and Pb, and from 0.025 ev to 10 Mev for the isotopes of U. A brief qualitative discussion of the relevant neutron interaction processes which occur for energies up to 14 Mev is given and methods of sampling angular distributions for Monte Carlo calculations are discussed. (W.D.M.)

6943 NP-8244

Joint Inst. for Nuclear Research., Dubna, U.S.S.R. Lab. of Theoretical Physics.

ON AN APPLICATION OF THE STATISTICAL VARIATIONAL PRINCIPLE TO THE THEORY OF ATOMIC NUCLEUS. V. G. Solov'ev (Soloviev) and Ten Geun. 1959. 7p. (P-407).

With the aid of the statistical variational principle the superfluid state of the nucleus at nonzero temperature was investigated. The temperature of the phase transition from the superfluid state into the normal one was obtained and the behavior of the thermodynamic quantities at the temperature close to $\theta \approx 0$ as well as at the temperature close to critical $\theta \approx \theta_0$ were investigated. (W.D.M.)

6944 NP-8255

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw and Joint Inst. for Nuclear Research, Dubna, U.S.S.R.

ELEKTRONY VNUTRENNEI KONVERSII ^{167}Tm. (Electron Internal Conversion of Tm^{167}). Report No. 115/1-A. S. Khoĭnatski, Kh. Lyantsman, R. Sosnovski, O. Volchek, Ya. Zhilich, and I. A. Yutlandov. Oct. 1959. 8p.

The internal conversion spectrum of Tm^{167} was investigated. A new conversion line at 477 kev was found, which was interpreted as the K-gamma of the 534-kev transition. On the basis of the present measurements and of published data, the accuracy of which has not been completely assured, E1 multipolarity could be assigned to the 534-kev transition. (tr-auth)

6945 ORO-235

Arkansas. Univ., Fayetteville.

NEUTRON ACTIVATION CROSS-SECTIONS WITH 14.8 MEV NEUTRONS IN THE REGION OF THE 28-PROTON CLOSED SHELL AND (n,He^3) REACTIONS WITH MEDIUM WEIGHT NUCLEI (thesis). Ivor Louis Preiss. Jan. 1960. 81p. Contract [AT(40-1)-277]. OTS.

Irradiations were made on Ni^{62}, Ni^{64}, Ni^{60}, Ni^{61}, Ni^{58}, Co, Zn, Cu, and Cu^{65} using 14.8-Mev neutrons from the T(D,n)He^4 reaction at 400 kev with the University of Arkansas Cockcroft-Walton accelerator. In a search for the (n,He^3) reactions, samples of P_2O_5, CuO, V^{51}, and Co^{59} were irradiated. (W.D.M.)

6946 UCRL-8855

California. Univ., Berkeley. Lawrence Radiation Lab.

RANGE AND RANGE STRAGGLING OF HEAVY RECOIL ATOMS (thesis). Ernest William Valyocsik. Nov. 1959. 43p. Contract W-7405-eng-48. OTS.

The range and range straggling of 96.8-kev Ra^{224} recoil atoms produced by alpha decay of Th^{228} have been measured in H_2, D_2, He, N_2, Ne, and Ar by a charged, parallel-plate, collection technique. The range and range straggling of 725-kev Th^{226} recoil atoms produced by bombardments of Ra^{226} with 41.6-Mev helium ions have been measured in D_2, He, N_2, and Ar by this same technique. Experimental results seem to indicate that the range-energy relation for the stopping of heavy recoils by nuclear collisions is not linear, as is theoretically predicted by Bohr. The distribution of ranges about the mean range appears to be Gaussian. Various factors contributing errors to the measured range stragglings are discussed in detail. F coil efficiencies of the heavy recoils produced in the (d, ,. (d,2n), (d,3n), and (d,p) reactions of Bi^{209} have been measured at incident deuteron energies of 15.0 to 23.6 Me for Bi^{209} targets of 0.6 to 42.5 μg/cm. The recoil effic encies of the different reaction products have been compare d on the basis of probable nuclear-reaction mechanism by which they are produced. Mean ranges for Po^{208} in Bi^{209} have been calculated from the recoil efficiencies. (auth)

6947 UCRL-8921

California. Univ., Berkeley. Lawrence Radiation Lab.

PHOTOPROTONS PRODUCED BY 245 ± 15-Mev GAMMA RAYS ON CARBON (thesis). Robert J. Cence. Nov. 1959. 52p. Contract W-7405-eng-48. OTS.

An experiment was performed, using the method of Weil and McDaniel, in which the interactions arising from 245 ± 15 Mev were selected out of all those produced by the bremsstrahlung spectrum of gamma rays from the Berkeley 342-Mev synchrotron. These interactions were selected by requiring a coincidence between each interaction and the degraded electron that produced the selected gamma ray. The energy spectrum of protons produced at 60 deg (lab) by these selected gamma rays impinging on a carbon target was measured. This spectrum covered a range from 105 to 250 Mev. A rather precise analysis was made by using the quasi-deuteron model of Levinger. In contrast with previous analyses, conservation of both momentum and energy were taken into account in a fairly accurate way. The results of the analysis depend on the momentum distribution of the centers of mass assumed for the quasi deuterons. The momentum distribution that gave the best fit to the

data is given by the sum of two Gaussian functions, one with a 1/e value of 1.6 Mev and the other with a 1/e value of 30 Mev. (auth)

6948 UCRL-8966

California. Univ., Berkeley. Lawrence Radiation Lab. 5-BEV NEUTRON CROSS SECTIONS IN HYDROGEN AND OTHER ELEMENTS (thesis). John H. Atkinson. Nov. 4, 1959. 80p. Contract W-7405-eng-48. OTS.

The neutron total and reaction cross sections of Pb, Sn, Cu, Al, C, and H were measured at 5.0 Bev. Transmission measurements were made in good and poor geometry. A high-energy neutron beam is produced when the Bevatron circulating proton beam strikes a copper target. Neutrons are identified by their production of pions in a beryllium block, which are then detected by a counter telescope including a gas Cherenkov counter. The threshold of this gas Cherenkov counter limits the mean effective neutron energy to 5.0 ± 0.4 Bev. (auth)

6949 AEC-tr-3945

Pu^{240} FISSION CROSS-SECTION BY NEUTRONS WITH THE ENERGY FROM 0.1 TO 4.0 MEV. V. G. Nesterov and G. N. Smirenkin. Translated by Lydia Venters (Argonne National Lab.) from a Russian report presented by the mission of scientists during their visit to Argonne National Lab. in November 1959. 10p. JCL or LC.

The energy dependence of the effective Pu^{240} fission cross section by fast neutrons in the energy region from 0.1 to 4.0 Mev was measured. The reaction $T(p,n)He^3$ served as the neutron source. Pu^{240} fission cross section in the "plateau" region (1 to 4 Mev) amounts to 1.6 barns and decreases twice at neutron energy $E_n \approx 0.7$ Mev. A steep decrease in the fission cross section continues to 0.3 Mev, reaching the value 0.1 barn, decreases slower in a continuously decreasing neutron energy and equals ~0.07 barn at $E_n \approx 0.1$ Mev. The correlation between irregularities in the course of fission cross section and levels of the Pu^{240} nucleus which correspond to the channels of inelastic scattering are discussed. (auth)

6950 AEC-tr-3946

CAPTURE CROSS SECTIONS OF FAST NEUTRONS IN TUNGSTEN AND MOLYBDENUM. Yu. Ya. Stavisskii and A. B. Shapar'. Translated by Lydia Venters (Argonne National Lab.) from a Russian report presented by the mission of scientists during their visit to Argonne National Laboratory in November 1959. 4p. JCL or LC.

The dependence of the radiative capture cross sections for fast neutrons on energy in the interval from 0.05 to 1 Mev for a natural mixture of W and Mo isotopes was measured by recording the prompt gamma rays with a CaF_2 crystal. The reaction $T(p,n)He^3$ was used as a neutron source. Experimental accuracy was about 6% at neutron energies from 0.05 to 0.2 Mev and 3% from 0.2 to 1 Mev. (W.D.M.)

6951

SCATTERING OF 38-Mev ALPHA PARTICLES BY C^{12}. J. Catalá, L. Miralles, and J. Aguilar (Instituto de Optica "Daza de Valdés," Valencia, Spain). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55, 241-4(1959) Sept.-Oct. (In Spanish)

The elastic and inelastic scattering differential cross section of alpha-particles by carbon has been studied at an energy of 38 Mev using nuclear emulsions. In the case of the elastic process, we obtain an approximate value for the radius of the interaction, using the diffraction formula for a strongly absorbing disk. (auth)

6952

ELASTIC SCATTEPING OF 19.5 Mev DEUTERONS BY CHLOROFORM. J. Aguilar and M. C. Altés (Instituto de Optica "Daza de Valdés," Valencia, Spain). Anales real soc. españ. fís. y quím. (Madrid), Ser. A 55, 245-50(1959) Sept.-Oct. (In Spanish)

The scattering of deuterons by chlorine has been studied at an energy of 19.5 Mev using the photographic technique. The angular distribution of the deuterons elastically scattered has been compared with the Rutherford formula and an approximate value is obtained for the radius of the interaction using the diffraction formula for a strongly absorbing disk. (auth)

6953

ABSOLUTE YIELDS OF THE XENON AND KRYPTON ISOTOPES IN U^{238} SPONTANEOUS FISSION. B. G. Young and H. G. Thode (McMaster Univ., Hamilton, Ont.). Can. J. Phys. 38, 1-9(1960) Jan.

The absolute abundances of the isotopes of fission-product xenon and krypton in six uranium minerals were determined mass spectrometrically using the isotope dilution technique. The fission products were resolved into a U^{238} spontaneous fission component, a U^{235} neutron-induced fission component, and a U^{233} neutron-induced fission component. Internal consistency in the analysis was achieved only when the Xe^{129} yield used for the U^{235} thermal neutron fission component was 20% lower than that reported by Purkayastha and Martin at I^{129}. This discrepancy in the mass 129 chain yield measured at I^{129} and at Xe^{129} was not resolved. Only one of the six minerals, Cinch Lake pitchblende, retained essentially all of its fission product inert gases throughout geological time. Inert gas losses from the remaining five minerals ranged from 20% to 75%. The absolute yields of the stable xenon and krypton fission products in U^{238} spontaneous fission were determined from an analysis of the inert gases from the Cinch Lake mineral. This analysis showed that 95.9% of the fission gas in this case resulted from the spontaneous fission and only 4.1% from neutron-induced fission. (auth)

6954

MEASUREMENT OF RADIATIVE CAPTURE RESONANCE INTEGRALS IN A THERMAL REACTOR SPECTRUM, AND THE THERMAL CROSS SECTION OF Pu-240. W. H. Walker, C. H. Westcott, and T. K. Alexander (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 38, 57-77(1960) Jan.

An apparatus is described which detects γ-rays emitted by a thin target placed in a well-defined neutron beam. It was used to determine the Cd ratios of Au and Pu^{240}, from which the ratio of the resonance integral to the 2200 m/s cross section for radiative neutron capture in Pu^{240} was deduced, using Au as a reference standard. Using this ratio and previously measured values of the resonance integral of Pu^{240} and its effective cross section in two positions in the NRX reactor, three separate estimates of the 2200 m/s cross section of Pu^{240} were made. The mean value is 270 ± 17 barns. In an auxiliary experiment to indicate the shape of the epithermal spectrum of the neutron beam, the activation Cd ratios of Mn and In were compared with that of Au. These results, combined with the known 2200 m/s capture cross sections of these nuclides, yield new values of the radiative capture resonance integrals for both Mn and In. (auth)

6955

THE NUCLEAR MATRIX ELEMENT RATIO IN THE $0^- \rightarrow 0^+$ BETA TRANSITION OF Pr^{144}. J. M. Pearson (McMaster Univ., Hamilton, Ont.). Can. J. Phys. 38, 148-9(1960) Jan.

The spectrum of the $0^- \rightarrow 0^+$ transition is determined

completely by a single nuclear matrix element ratio, $\lambda = i\,(\gamma_5)/(\mathbf{d}\cdot\mathbf{r})$. This transition is believed to take place in the ground state decay of Pr^{144}, which was recently well measured. The measured volume of λ was found to be positive and quoted at $\lambda = 5 \pm 2$. This is in conflict with a previous estimate by Ahrens and Feenberg (1952), whose method gives $\lambda \approx -12$. The question of agreement or disagreement between theory and experiment depends essentially on the sign of the non-relativistic limit of (γ_5). (B.O.G.)

6956

LEVEL SCHEME OF Pr^{144}. A. K. Sengupta, R. Bhattacharyya, J. Lahiri, and P. N. Mukherjee (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 33, 388-94 (1959) Sept.

The level scheme of Pr^{144} following β-decay of Ce^{144} was studied with a Siegbahn-Slätis β-ray spectrometer and scintillation spectrometers. Three β-groups were observed with end-point energies and relative intensities as 184 (26%), 240 (8%), and 312 kev (66%). Corresponding gamma-rays of energies 53, 81, and 134 kev were detected. Internal conversion lines of these transitions along with those of some other γ-lines of energies 33, 38, 42, 59, and 95 kev were observed. K/L ratio and half-time measurement of the 134 kev γ-line indicate an M1 multipolarity for this transition. Coincidence studies were made and a tentative decay scheme proposed. (auth)

6957

NEUTRON STRENGTH FUNCTION $\overline{\Gamma n}^0/D$ WITH COMPLEX DIFFUSE BOUNDARY POTENTIAL. Arundhati Ghosh (Indian Assn. for the Cultivation of Science, Calcutta). Indian J. Phys. 33, 395-400(1959) Sept.

The strength function $\overline{\Gamma n}^0/D$ which is the average value of neutron width to level spacing and the effective radius R' are calculated with a complex spherical well having a diffuse boundary. The values of the parameters involved in the potential function are fixed by comparing curves for the strength function with the same as given by Weisskopf. The S-state energy eigenvalues calculated with the above parameters are in agreement with similar calculations of Green and Lee. (auth)

6958

SPALLATION REACTIONS OF CALIFORNIUM-252 WITH HELIUM IONS. T. Sikkeland, S. Amiel, and S. G. Thompson (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 11, 261-3(1959) Dec.

Cross sections were determined for $Cf^{252}(\alpha,xn)$ and (α,pxn) reactions. The product of the $(\alpha,3n)$ reaction, Fm^{253}, was found to have a half life of 3.0 ± 0.2 days and the most abundant α-particle energy was 6.95 ± 0.05 Mev. From the decay of Fm^{253}, the electron-capture daughter Es^{253} was found to have an electron-capture to α-decay branching ratio of 8.5 ± 1.0. (C.J.G.)

6959

VIBRATIONAL STATES IN U^{234} EXCITED BY Np^{234} DECAY AND EVIDENCE FOR AN E0-TRANSITION BETWEEN STATES WITH $I \neq 0$. C. J. Gallagher, Jr. (California Inst. of Tech., Pasadena) and T. D. Thomas (Univ. of California, Berkeley). Nuclear Phys. 14, 1-20(1959) Dec. (1). (In English)

Transitions following the EC-capture decay of 4.4-day Np^{234} were investigated with 99-, 160-, and 350-gauss permanent magnets, a solenoidal "long lens" spectrometer, and NaI(Tl) scintillation detectors with a 100-channel analyzer. Many internal conversion electron lines were observed, and assigned to transitions at 43.49, 99.70, 233.6, 234.6, 238.6, 247.9, 297.6, 450.5, 482.8, 485.1, 515.7, 525.9, 556.8, 744.1, 751.7, 767.9, 787.8, 793.8, 810.0, 812, 854, 1003, 1105, 1196, 1240, 1395, 1439, 1531, 1562, 1575, and 1606 kev. A few other weak electron lines were observed, but not assigned to transitions. Transitions following Np^{236}, Np^{238}, and Np^{239} decay were also observed on the same plates and identified, helping to ensure correctness of the isotopic assignment of the U^{234} transitions. The above transitions have been interpreted to establish levels in U^{234} at 43.49, 143.2, 788, 812, 854, 1049, 1090, 1092, 1240, 1340, 1439, 1575, and 1606 kev. The 812-kev E0 transition was resolved into two components, one of which is interpreted to be an E0-transition between two 2^+ states. Transition multipolarities and possible level spin and parity assignments are discussed. A comparison of the known data on relative energies of vibrational states indicates that the β-vibrational states have lower energies than the γ-vibrational states in the few nuclei where the energies of both are known. (auth)

6960

PAIRING ENERGY EFFECTS IN EXCITED NUCLEI. D. W. Lang and K. J. Le Couteur (Australian National Univ., Canberra). Nuclear Phys. 14, 21-32(1959) Dec. (1). (In English)

The nucleus is considered as a Fermi gas with pairs of degenerate single particle states and a coupling energy Δ between the two states of a pair. A statistical treatment gives expressions for the density of excited states and the expected value of the total angular momentum. Suitable approximations for purposes of calculation are indicated. All the formulas become equivalent to those of a simple Fermi gas at high enough excitations. (auth)

6961

E2 TRANSITIONS FROM THE SECOND 2+ LEVEL OF EVEN-EVEN NUCLEI. D. M. Van Patter (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Nuclear Phys. 14, 42-69(1959) Dec. (1). (In English)

A survey was made of available data for the γ-ray branching of the second 2+ level of over 50 even nuclei with $A > 30$, together with data for the E2–M1 mixing of the $(2' \rightarrow 2)$ cascade transition. In addition, presently available data for the Coulomb excitation cross sections for the second 2+ level of some 24 even nuclei were collected. From these data, three ratios of reduced E2 transition probabilities were calculated, and compared with the predictions of various theories. The comparisons indicate that by far the most successful theory to date for predicting such ratios is the recent asymmetric rotor model of Davydov and Filippov. Perhaps the most striking success of this theory is the prediction for the ratio $B(E2; 2' \rightarrow 0)/B(E2; 2 \rightarrow 0)$ as a function of the energy ratio $E_2(2+)/E_1(2+)$. However, there are some experimental results which remain unexplained, particularly for the ratio $B(E2; 2' \rightarrow 2)/B(E2; 2' \rightarrow 0)$. (auth)

6962

EVEN NUCLEI WITHOUT AN AXIS OF SYMMETRY. N. MacDonald (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nuclear Phys. 14, 70-7(1959) Dec. (1). (In English)

The low lying levels of even nuclei, and the electric quadrupole transition probabilities between certain of these levels, are discussed in terms of the rotation of a nucleus without axial symmetry. The moments of inertia of the nucleus are not restricted to those prescribed by the hydrodynamical model. Use is made of a prescription due to Moszkowski. This contains a parameter p whose value depends on the residual interaction, and which in varying from 0 to 1 causes the moments of inertia to vary from the

rigid body values to approximately the hydrodynamical values. It was found that to obtain agreement with the experimental data on the transitions it was necessary to have p larger than the values which give the correct values of the energy of the first excited state in the case of nuclei having a small deviation from axial symmetry. (auth)

6963

INELASTIC NEUTRON SCATTERING IN Nb^{93}. N. Nath, M. A. Rothman, D. M. Van Patter, and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Nuclear Phys. 14, 78-96(1959) Dec. (1). (In English)

Study of gamma ray spectra following inelastic neutron scattering in Nb^{93} was made at bombarding energies ranging from 0.81 to 2.25 Mev. Measurement of thresholds for the gamma rays and the gamma-gamma coincidence spectra has enabled us to work out a level scheme for Nb^{93}. The energies of the two levels previously reported were revised to 0.741 and 0.958 Mev. In addition, levels were found at 0.809, 1.08, 1.28, 1.34, 1.48, 1.67, and 1.92 Mev. In all, fourteen gamma-ray transitions were detected and the possibility of a few more is indicated. In suitable cases, branching ratios were calculated. Gamma ray production cross-sections were tabulated. Theoretical calculations of the cross sections for the first five levels, using a diffuse-edge potential well, give fairly good agreement with the experiment. Probable spin assignments for the second to fifth excited states were discussed. (auth)

6964

γ_5 SYMMETRIES AND RELATIVISTIC CORRECTIONS IN BETA DECAY. Masato Morita (Columbia Univ., New York). Nuclear Phys. 14, 106-16(1959) Dec. (1). (In English)

Making the postulate that the four-fermion interaction must be invariant under the mass reversal transformation $\psi \rightarrow \gamma_5\psi$ and $m \rightarrow -m$, for every pair of the four fields simultaneously, the V−A interaction where $C_V = -C_A$, $C_V' = -C_A'$ and C_V/C_V' is arbitrary, is obtained. This invariance property is very useful in finding a similarity between the nth and the (n ± 1)th forbidden transitions in beta decay. In particular, corrections due to the relativistic matrix elements are given for the various formulas describing all kinds of the phenomena in the allowed beta decay. The Coulomb corrections and the finite de Broglie wavelength effect are taken into account simultaneously. (auth)

6965

ON THE SPLITTING OF THE PEAK IN THE NEUTRON STRENGTH FUNCTION NEAR A = 55. J. M. Leblanc, R. E. Coté, and L. M. Bollinger (Argonne National Lab., Lemont, Ill.). Nuclear Phys. 14, 120-30(1959) Dec. (1). (In English)

The results of neutron transmission measurements on bromine and selenium and their enriched isotopes are presented. Resonance parameters were determined for six resonances in Br^{79}, three in Br^{81}, and a total of eight in the various enriched isotopes of selenium. The values of $\overline{\Gamma_n^0}/D$ for Br^{79} and Se^{80} are determined from these parameters. These new values of the strength function are compared with those for neighboring nuclides. The combined results give a clear indication that the peak in the neutron strength function near nucleon number 55 shows a splitting similar to that of the maximum near A = 155. (auth)

6966

NUCLEAR ABSORPTION OF GAMMA RAYS IN Al, Si, P, S AND Ca. J. Dular, G. Kernel, M. Kregar, M. V. Mihailović, G. Pregl, M. Rosina, and Č. Zupančič (Institute "J. Stefan," Lubljana, Yugoslavia). Nuclear Phys. 14, 131-9(1959) Dec. (1). (In English)

Bremsstrahlung absorption spectra are measured in five elements, using a magnetic Compton spectrometer. By subtracting theoretical atomic absorption cross sections the energy dependence of the nuclear absorption cross sections is obtained. However, the absolute value of the nuclear absorption cross section has not been accurately determined. (auth)

6967

AN AID IN THE DETERMINATION OF NUCLEAR SPINS. R. K. Sheline and H. L. Nielsen (Florida State Univ., Tallahassee). Nuclear Phys. 14, 140-4(1959) Dec. (1). (In English)

Intensities of the α groups collected in the backward angle from the $Al^{27}(d,\alpha)Mg^{25}$ reaction were analyzed after recording them on nuclear emulsions over an extended range of excitation. Given intensities are determined with an average deviation of ≈15%. Normalizing the intensities by 2I + 1 and barrier penetration factors produces intensities which are the same within an average deviation of 33%. Use of intensities as an aid in determining spin is suggested. (auth)

6968

DECAY OF Ba^{140} P. Boskma and H. De Waard (Natuurkundig Laboratorium der Rijksuniversiteit, Groningen, Netherlands). Nuclear Phys. 14, 145-54(1959) Dec. (1). (In English)

The decay of Ba^{140} to La^{140} was investigated by means of a coincidence magnetic spectrometer and β- and γ-scintillation coincidence techniques. A uniquely determined level scheme was presented. (auth)

6969

THE ABSOLUTE MEASUREMENT OF RADIOACTIVE ISOTOPES WHICH DECAY BY ELECTRON CAPTURE. D. H. Vincent (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Nukleonik 1, 332-6(1959) Dec. (In German)

A method for the measurement of the emission rate of K quanta from isotopes which decay through electron capture is described. The utilization of a spherical counter permits the more accurate determination of the sensitivity of the counter by measurement of the counting rate as a function of the pressure of the counter gas. Standard measurements were made on Mn^{54} and Fe^{55} The results show good reproducibility within the specified limits of error. (tr-auth)

6970

ELASTIC SCATTERING AND POLARIZATION OF HIGH-ENERGY NUCLEONS BY NUCLEI. A. M. Saperstein and D. Feldman (Brown Univ., Providence). Nuovo cimento (10) 14, 457-78(1959) Nov. 1. (In English)

The cross section and polarization for the elastic scattering of protons by carbon and lead at 135 Mev and by carbon at 300 Mev were evaluated in the impulse approximation using the nucleon-nucleon phase-shift sets of Signell-Marshak, Gammel-Thaler, Ohnuma-Feldman, and Stapp. The detailed calculations were carried out both in ordinary Born approximation and also in terms of a modified Born approximation in which account is taken of the absorption of the elastically scattered nucleon wave within the nucleus. Relativistic effects were estimated and found to be small. The possibility of distinguishing among the various sets of nucleon-nucleon phase shifts is discussed. (auth)

6971

THE DECAY OF ^{44}Ti. E. W. Cybulska and L. Marquez (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Nuovo cimento (10) 14, 479-83(1959) Nov. 1. (In English)

The decay of Ti^{44} was studied using scintillation spectrometer, coincidence, and delayed coincidence methods. It was found that Ti^{44} decays by electron capture to the second excited state of Sc^{44}. This is followed by a γ-ray of 79 kev and then a γ-ray of 70 kev. The 70 kev state is metastable with a half life of 0.18 μsec. (auth)

6972

FURTHER WORK ON THE DECAY OF THALLIUM 202. S. Jha and H. G. Devare (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 14, 509-15(1959) Nov. 1. (In English)

Radiations from 12 day Tl^{202} were studied in scintillation coincidence spectrometers. In addition to the well-known γ-ray of 440 kev energy, a very low intensity γ-ray of energy 960 kev was found showing that the electron capture decay of Tl^{202} leads to the 440 kev and 960 kev states of Hg^{202}. By the sum-coincidence technique and the conventional coincidence technique, it was shown that the 960 kev state de-excites also by the cascade emission of 440 kev and 520 kev γ-rays. By measuring the ratio of the number of captures from the K shell and that from L, M ... shells, the decay energy of Tl^{202} was calculated to be (980^{+}_{-}) kev. (auth)

6973

MESON-NUCLEON SCATTERING IN THE S-STATE AND MESON-MESON INTERACTIONS IN FIXED SOURCE THEORY. I. SCATTERING BY THE SOURCE. G. Bonnevay (Ecole Normale Supérieure, Paris). Nuovo cimento (10) 14, 593-611(1959) Nov. 1. (In French)

The values for the S-phase shifts of meson-nucleon scattering are discussed as deduced from fixed-source theory considered as the limit of relativistic pseudoscalar charge-independent theory. The coupling constant was determined by the P scattering. The scattering amplitudes thus obtained are too large, and both of the same sign. They serve as a starting place for a later work in which incident meson scattering by the field of the target nucleon will be considered. (tr-auth)

6974

THE β-DECAY OF ^{234}Pa (UZ). P. W. De Lange, H. Schneider, and J. W. L. De Villiers (Council for Scientific and Industrial Research, Pretoria). Nuovo cimento (10) 14, 681-703(1959) Nov. 16. (In English)

The β and γ ray spectra observed in the decay of UZ (6.66 hr) were investigated. Results of β-γ-coincidence measurements are given. Gamma-gamma-coincidences obtained with selected γ photopeaks in a scintillation unit are discussed. A decay scheme involving 6 β-transitions and 39 γ-transitions is presented. It is proved that UZ is the ground state of Pa^{234} with UX2 (22 ± 12) kev above it. A spin of 6^{-} for UZ is explained in terms of Nilsson states. (auth)

6975

MEASUREMENT OF LONGITUDINAL POLARIZATION OF β^{-} ELECTRONS FROM ^{204}Tl BY MEANS OF DOUBLE COULOMB SCATTERING. M. Bernardini, P. Brovetto, S. Ferroni, and A. Pasquarelli (Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 14, 787-95(1959) Nov. 16. (In English)

Longitudinal polarization of β^{-} electrons emitted by Tl^{204} was measured using the double Coulomb scattering technique. The observed effect is lower (by about 10%) than expected for $-v/c$ polarized electrons. The present result of $\Delta_{th} = 0.165$ agrees, within experimental errors with that obtained in a previous work by measuring the circular polarization of the bremsstrahlung γ-rays. (auth)

6976

TRANSVERSE POLARIZATION IN ALLOWED β TRANSITIONS. R. H. Good, Jr. and M. E. Rose (Oak Ridge National Lab., Tenn.). Nuovo cimento (10) 14, 872-86(1959) Nov. 16. (In English)

In an allowed β-transition, in which the recoil direction is observed in coincidence with the β-particle, it is possible under appropriate circumstances to produce completely polarized electrons. For pure Fermi transitions no additional conditions need be imposed. For Gamow-Teller transitions it is also necessary that the nucleus be oriented and, if the alignment is zero, the nuclear polarization must have the maximum possible value consistent with this condition, namely $^{2}/_{3}$. Also, in a Gamow-Teller transition from a completely polarized nucleus to a nucleus with one lower spin-value, the electron polarization is complete even without observation of the recoil. In general, the polarization of the β-particle is at least partly transverse. The conditions for purely transverse polarization are investigated. For Fermi transitions, where the transverse polarization would have unit value, this can be accomplished at any energy but the effect can be observed, in principle, only for monoenergetic electrons. A discussion is given of the appropriate form of the electron-positron polarization operator. (auth)

6977

SOME DATA ON THE INTERACTIONS OF HIGH ENERGY PROTONS WITH LIGHT NUCLEI (C,O). E. Fiorini and S. Ratti (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 14, 901-4(1959) Nov. 16. (In Italian)

The interactions of high-energy protons with the carbon and oxygen atoms of a Plexiglas baffle of a Wilson chamber were studied. The percentage of various types of interaction was determined and compared with previous experimental and theoretical data. The results confirm the hypothesis of a substructure instantaneously formed in the collision of the light nucleus. The angular distribution between the fast secondary and the primary is compared with the results obtained by the Monte Carlo method. The experimental angular distribution is in agreement with the hypothesis of the existence of a substructure. The experimental angular distribution between the two fast secondaries of stars with three branches is non-symmetrical with respect to 90°. (J.S.R.)

6978

EFFECT OF SIMULTANEOUS DOPPLER AND COLLISION BROADENING AND OF HYPERFINE STRUCTURE ON THE IMPRISONMENT OF RESONANCE RADIATION. P. J. Walsh (Westinghouse Electric Corp., Bloomfield, N. J.). Phys. Rev. 116, 511-15(1959) Nov. 1.

The transmission coefficient defined by Holstein for resonance radiation was calculated when Doppler and collision broadening of the resonance line are present simultaneously. From this a simple formula is inferred for the imprisonment lifetime of the resonance radiation under this condition. The complication of the hyperfine structure is also taken into account and the results are found to give good agreement with experiments in mercury. (auth)

6979

NUCLEAR SPIN-LATTICE RELAXATION IN METALS.

A. G. Anderson and A. G. Redfield (Columbia Univ., New York). Phys. Rev. 116, 583-91(1959) Nov. 1.

The nuclear spin-lattice relaxation time, T_1, was measured in the range of 1.1 to 4.2°K for the metals lithium, sodium, aluminum, and copper. A combination of nuclear magnetic resonance at fixed frequency and adiabatic variation of the magnetic field was used to measure T_1 as a function of field between zero and one thousand gauss. At fields of between one hundred and one thousand gauss T_1 is independent of magnetic field and inversely proportional to temperature in agreement with theory. The experimental values of the relaxation time multiplied by absolute temperature in sec °K are 44 ± 2.0 for Li^7; 5.1 ± 0.3 for Na^{23}; 1.80 ± 0.05 for Al^{27}; 1.27 ± 0.07 for Cu^{63}. These values are in good agreement with previous experimental data at room temperature and above. At fields comparable with the nuclear magnetic dipole-dipole fields, T_1 is a function of applied field. The theory of relaxation in low fields is presented in an elementary form. Qualitative agreement with theory is obtained for Al^{27} and Cu^{63}; detailed agreement is obtained for Li^7 and Na^{23}. (auth)

6980

MEASUREMENT OF THE L/K-CAPTURE RATIO IN Fe^{55} DECAY. J. Scobie, R. B. Moler, and R. W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev. 116, 657-60(1959) Nov. 1.

The L and K x-radiations of manganese resulting from orbital-electron capture in a gaseous source of Fe^{55} were studied in a multiwire proportional counter. The L/K-capture ratio was found to be 0.108 ± 0.006, in good agreement with the theoretical value. (auth)

6981

COLLECTIVE ENHANCEMENT OF E2 MATRIX ELEMENTS IN LIGHT NUCLEI. S. Fallieros and R. A. Ferrell (Univ. of Maryland, College Park). Phys. Rev. 116, 660-73(1959) Nov. 1.

Several electric quadrupole transitions in nuclei in the neighborhood of O^{16} are discussed. The well-known strong enhancement of the single-nucleon matrix elements is interpreted as resulting from the virtual excitation of a collective 2+ state in the O^{16} core. It is found that an energy of 18 Mev for this state gives a satisfactory account of all of the experimental data. The enhanced matrix elements are expressed in terms of an effective charge, which is calculated in detail within the framework of the nuclear shell model. The value of the effective charge depends on the particular independent-nucleon states involved in the transition and is found to be approximately 0.5, 0.7, and 0.9 for 2s – 1d, 1d – 1d, and 1p – 1p matrix elements, respectively. Of special interest is the result that the N^{14} quadrupole moment should possess the relatively large value of 3×10^{-26} cm^2, or about three times the simple shell-model value. This prediction was recently confirmed by high-energy electron scattering measurements. The relation of the present work to previous theoretical treatments of enhancement by the methods of the hydrodynamic model and of configuration mixing is discussed. The Appendix on center-of-mass effects contains an explicit demonstration of the cancelling of the classical recoil quadrupole moment of O^{17} by a quantum mechanical exchange term. (auth)

6982

ZERO-SPIN EXCITED STATE IN Ca^{42}. I. Asplund and T. Wiedling (Univ. of Stockholm). Phys. Rev. 116, 741-3 (1959) Nov. 1.

An angular correlation measurement was carried out on the 0.3 Mev to 1.5 Mev gamma cascade in Ca^{42}. It is shown that the observed angular correlation function $W(\theta) = 1 + 0.33P_2(\cos\theta) + 1.07P_4(\cos\theta)$ fits the spin sequence 0-2-0. (auth)

6983

HALF-LIFE AND BETA SPECTRUM OF Rb^{87}. K. F. Flynn and L. E. Glendenin (Argonne National Lab., Lemont, Ill.). Phys. Rev. 116, 744-8(1959) Nov. 1.

Liquid-scintillation counting techniques were applied to the measurement of the specific activity and the beta spectrum of the natural radioactivity of rubidium. The measured Rb^{87} half life is $(47.0 \pm 1.0) \times 10^9$ yr, and the observed maximum beta energy is 272 ± 3 kev. (auth)

6984

THEORETICAL CALCULATION OF THE BINDING ENERGY OF O^{16}. Paul Goldhammer (Univ. of Nebraska, Lincoln). Phys. Rev. 116, 676-82(1959) Nov. 1.

The second-order perturbation procedure of Bolsterli and Feenberg is applied to the ground state of O^{16}. The two-body interaction operator employed has a Serber exchange character with repulsive core and tensor component, determined to give a reasonable fit to the properties of H^2, H^3, He^3, and He^4 to the accuracy of the perturbation procedure. The resulting eigenstate for O^{16} is found to have energy eigenvalue −129.2 Mev and rms radius 2.33×10^{-13} cm. Coulomb forces are neglected. Components in the wave function different from the zero-order shell-model state are found to have a statistical weight of about 18%. (auth)

6985

MONTE CARLO CALCULATIONS OF NUCLEAR EVAPORATION PROCESSES. III. APPLICATIONS TO LOW-ENERGY REACTIONS. I. Dostrovsky and Z. Fraenkel (The Weizmann Inst. of Science, Rehovoth, Israel) and G. Friedlander (Brookhaven National Lab., Upton, N. Y. and The Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 116, 683-702(1959) Nov. 1.

Monte Carlo calculations of nuclear reactions in the low-energy (E < 50 Mev) region are described. The calculations are based on the nuclear evaporation model of Weisskopf. Continuum theory was used for the calculation of inverse reaction cross sections. In the calculation of the level densities of excited nuclei, pairing and shell energy corrections were used in terms of characteristic level displacements. The accurate equation rather than the approximate Maxwell distribution was used for the selection of the kinetic energy of the evaporated particle. Experimentally determined Q-values for the various reactions were used. The calculations are compared with experimental measurements for about 60 excitation functions of nuclear reactions in the mass range Cr^{50}–Se^{74}. Cameron's values for pairing energies were used at the outset; but a new set of pairing and shell energy correction values, which leads to substantially improved agreement with the experimental curves, is presented. The procedure which was used to arrive at this set is described and several features of the set are discussed. The need for a further downward correction of the level density of symmetrical (A = 2Z) nuclei is indicated. Computed excitation functions are shown for all the reactions studied as well as for several reactions for which experimental data are not yet available. Further experiments on reaction cross sections are suggested which would allow a unique determination of the pairing and shell energy corrections of level densities for any

value of Z and N in the region under discussion. The existence of a unique set of these correction terms would provide strong evidence for the validity of evaporation theory for the reactions considered. (auth)

6986

PHENOMENOLOGICAL NUCLEAR INTERACTION DERIVED FROM BINDING ENERGIES. R. Thieberger (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 116, 713-19(1959) Nov. 1.

An attempt is made to clarify the basis of a formula for binding energies derived in the framework of the j-j coupling shell model. Studies are made of the effect of three-body correlations, by introducing a density dependent term. It is seen that the j-j coupling calculation can be suitably corrected for the many body effects. The hard-core influence is introduced as a pseudopotential. An attempt is made to fit the binding energies with a phenomenological central potential, including a density-dependent term. The best exchange mixture obtained is not far from a Serber type but includes a considerable amount of Bartlett force. When the hard core is included, the best exchange mixture becomes of the Serber type. With this potential a good fit is obtained over a large range of configurations. (auth)

6987

ELECTRON CAPTURE DECAY OF Lu^{173} TO LEVELS IN Yb^{173}. J. W. Bichard and J. W. Mihelich (Univ. of Notre Dame, Ind.) and B. Harmatz (Oak Ridge National Lab., Tenn.). Phys. Rev. 116, 720-4(1959) Nov. 1.

The electron capture of Lu^{173} (1.30 yr) to levels in Yb^{173} was investigated using scintillation spectrometers and permanent magnet spectrographs. Levels in Yb^{173} were observed at 78.7 (7/2−), 179.5 (9/2−), 351.2 (7/2+), and 636.8 (7/2−) kev. The first two excited states may be interpreted as members of a rotational band based on the ground state [(512) 5/2−]. The levels at 351 and 637 kev are probably the intrinsic levels [(633) 7/2+] and [(514) 7/2−], respectively, predicted by Nilsson. L electron capture was observed to be the primary mode of population of the 637-kev level. Relative reduced transition probabilities were obtained for all transitions to the ground-state rotational band, and comparisons with theoretical branching ratios were made. Log(ft) values were estimated from the observed K-capture branching ratios. (auth)

6988

NUCLEAR RESONANCE FLUORESCENCE IN Ce^{140}. S. Ofer and A. Schwarzschild (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 116, 725-9(1959) Nov. 1.

Measurements of the lifetime of the 1.6-Mev first excited state of Ce^{140} were performed using the nuclear resonance fluorescence method. Self-absorption experiments using Ce metal and CeO_2 scatterers and absorbers performed at 300 and 78°K yield a mean life of $(1.10 \pm 0.15) \times 10^{-13}$ second for this state. Formulas are presented for the analysis of resonance fluorescence experiments using thick scatterers and absorbers. (auth)

6989

LIFETIMES OF 2^+ ROTATIONAL STATES. M. Birk, G. Goldring, and Y. Wolfson (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 116, 730-3(1959) Nov. 1.

The mean lives of the rotational 2^+ states of nuclei in the region $150 \leq A \leq 186$ were measured with a pulsed proton beam timing device. The presence of prompt proton bremsstrahlung requires more elaborate analysis of the time distributions than the customary determination of center of gravity shift. In order to achieve the necessary accuracy and freedom from drift, a beam switching procedure was introduced, alternating the beam between two targets and therefore allowing accurate comparisons to be made. A measurement of the mean life of B^{10}, carried out as a check, yielded results in good agreement with previous measurements. A method for utilizing the lifetime measurements for accurate determinations of B(E2) values is discussed. (auth)

6990

NUCLEAR SPIN, HYPERFINE-STRUCTURE SEPARATION, AND MAGNETIC MOMENT OF 22-HOUR POTASSIUM-43. F. Russell Petersen, Vernon J. Ehlers, W. Bruce Ewbank, Lawrence L. Marino, and Howard A. Shugart (Univ. of California, Berkeley). Phys. Rev. 116, 734-7(1959) Nov. 1.

With the atomic-beam magnetic-resonance method, the nuclear spin and hyperfine-structure separation were measured for 22-hour K^{43}. The results are $I = 3/2$, $\Delta\nu(^2S_{1/2}) = 192.64 \pm 0.05$ Mc/sec. The nuclear magnetic moment calculated from these measurements is $|\mu| = 0.163 \pm 0.002$ nuclear magneton. (auth)

6991

ELECTRON CAPTURE OF THE ACCIDENTAL RESONANCE TYPE. D. R. Bates and N. Lynn (Queen's Univ., Belfast). Proc. Roy. Soc. (London) A253, 141-53(1959) Nov. 24.

Consideration is given to the characteristics of electron capture of the accidental resonance type exemplified by $He^{2+} + H(1s) \rightarrow He^+ (2s \text{ or } 2p) + H^+$. In contrast to what happens when the resonance is symmetrical, as in $H^+ + H(1s) \rightarrow H(1s) + H^+$, the cross-section is small at low velocities of relative motion and tends rapidly toward zero as the velocity is decreased, the behavior being, in fact, almost adiabatic. This is of interest in several connections: for instance, it is of interest in aeronomy where the processes $H^+ + O(^3P) \rightarrow H(1s) + O^+(^4S)$ and $O^+(^2D) + N_2(X\,^1\Sigma_g^+, v''=0) \rightarrow O(^3P) + N_2^+(A^2\Pi_u, v'=1)$ were assumed by some workers to occur rapidly in thermal encounters simply because the energy balance is almost exact; and again it is of interest in relation to the mobility of a molecular ion in its parent molecular gas. (auth).

6992

THE BINDING ENERGIES OF ATOMIC NUCLEI. II. SELF-CONSISTENCY AND THE DEFINITION OF THE t-MATRIX. R. J. Eden, V. J. Emery, and S. Sampanthar (Cambridge Univ., Eng.). Proc. Roy. Soc. (London) A253, 177-85(1959) Nov. 24.

The method for applying Brueckner theory to finite nuclei described in a previous paper is extended to improve the self-consistency and to take account of tensor forces. The equations are set up for the application of the method to O^{16}. (auth)

6993

THE BINDING ENERGIES OF ATOMIC NUCLEI. III. NUCLEAR FORCES AND THE GROUND STATE OF OXYGEN-16. R. J. Eden, V. J. Emery, and S. Sampanthar (Cambridge Univ., Eng.). Proc. Roy. Soc. (London) A253, 186-98(1959) Nov. 24.

The rms radius and the binding energy of oxygen-16 are calculated for several different internucleon potentials. These potentials all fit the low-energy data for two nucleons, they have hard cores of differing radii, and they include the Gammel-Thaler potential (core radius 0.4 fermi). The calculated rms radii range from 1.5 f for a potential with core radius 0.2 f to 2.0 f for a core radius 0.6 f. The value obtained from electron scattering experi-

ments is 2.65 f. The calculated binding energies range from 256 Mev for a core radius 0.2 f to 118 Mev for core 0.5 f. The experimental value of binding energy is 127.3 Mev. The 25% discrepancy in the calculated rms radius may be due to the limitations of harmonic oscillator wave functions used in the unperturbed system. (auth)

6994

THE RANGE OF ELECTRONS AND POSITRONS OF LOW ENERGY IN COPPER, SILVER, AND GOLD. K. Gubernator and A. Flammersfeld (Universität, Göttingen, Ger.). Z. Physik 156, 179-88(1959). (In German)

In continuation of previous work the range of 40 to 160 kev monoenergetic electrons and positrons in copper, silver, and gold is determined and the corresponding range-energy-relations are stated. In copper the positrons have a shorter range than electrons of the same energy, but in silver and gold they have a longer range, in disagreement with the values calculated by Nelms. For the three absorption materials all the ranges of electrons can be described by the formula $E^- = 14.3 \times (Z^{\frac{1}{2}}/A) \times R^{0.61}$, and all the ranges of positrons by $E^+ = 29.7 \times (Z/A) \times R^{0.60}$ (E in kev, R in mg/cm^2). The ratio of the range of positrons to that of electrons for copper agrees rather well with the calculated one, but for silver and gold it differs considerably. This might be due to the increasing influence of the elastic scattering of the particles on nuclei. (auth)

6995

DETERMINATION OF THE HYPERFINE STRUCTURE SPLITTING OF THE SCANDIUM GROUND STATES $^2D_{3/2}$ AND $^2D_{5/2}$ AND THE QUADRUPOLE MOMENT OF THE Sc^{45} NUCLEUS. G. Fricke, H. Kopfermann, S. Penselin, and K. Schlüpmann (Universität, Heidelberg, Ger.). Z. Physik 156, 416-24(1959). (In German)

The hyperfine structure splittings of the electronic ground states $^2D_{3/2}$ and $^2D_{5/2}$ of the stable isotope Sc^{45} were measured by the atomic beam magnetic resonance method. From these splittings the magnetic dipole and electric quadrupole interaction constants are found to be

$a_{3/2} = (269.560 \pm 0.02)$ Mc/s $b_{3/2} = -(26.37 \pm 0.1)$ Mc/s
$a_{5/2} = (109.034 \pm 0.01)$ Mc/s $b_{5/2} = -(37.31 \pm 0.1)$ Mc/s.

The values of the electric quadrupole moment calculated from $b_{3/2}$ and $b_{5/2}$ differ by about 5% indicating that the configuration 3d 4s^2 of the ground states is perturbed by higher configurations. Averaging these two values we obtain for the quadrupole moment of Sc^{45} $Q(Sc^{45}) = -(0.22 \pm 0.01) \times 10^{-24}$ cm^2. (auth)

6996

TREATMENT OF THE GROUND STATE OF LIGHT NUCLEI. F. Beck (Universität, Heidelberg, Ger.). Z. Physik 156, 555-60(1959). (In German)

A treatment for obtaining the ground state energy of nuclei, interacting via short range singular two-body interactions, is proposed which combines a variational procedure with the two-particle correlations, obtained from solutions of the Bethe-Goldstone equation. Although no numerical results have been obtained so far, it is hoped that the combination will have some advantage over the usual t-matrix treatment. The lowest order correction to the t-matrix energy, if self-consistency is not strictly fulfilled (as is always the case in practical calculations), is given. Numerical calculations will be difficult except for the lightest nuclei. (auth)

6997

TWO-QUANTUM TRANSITIONS IN NUCLEAR ISOMERS. Jorg Eichler and Gerhard Jacob (Universität, Heidelberg, Ger.). Z. Physik 157, 286-300(1959) Nov. (In German)

Two-quantum emission in nuclei proceeds with such a small probability that it can hardly be detected unless all competing processes are strongly suppressed. Most favorable would be an excited level that can decay only by a $0^+ - 0^-$ transition but, unfortunately, such a case is not yet known. Another possibility for detecting two quantum transitions might be provided by nuclear isomerism. An isomeric single quantum transition of a high multipolarity may be replaced by the emission of two quanta of lower multipolarities. The calculated angular correlation is generally not symmetric about 90°. The total transition probability and the distribution of energy between the two quanta have been evaluated using the single particle model. The experimental possibility of observing two quantum processes is discussed. (auth)

6998

NUCLEAR RESONANCE IN WEAK MAGNETIC FIELDS. NUCLEAR AMPLIFIER. S. Wilking (Technische Hochschule, Karlsruhe, Ger.). Z. Physik 157, 384-400(1959) Nov. (In German)

A method is described for observing nuclear magnetic resonance effects in weak magnetic fields. A liquid flows successively through three different magnetic fields: a polarizer field, a weak intermediate field, and a detector field. In the polarizer field a resultant nuclear magnetization occurs which follows the local field orientation and is measured in the detector field with an autodyne detector. An alternating field of suitable frequency which is irradiated in the intermediate field changes the occupation number difference or rotates the magnetization vector. If the nuclear relaxation times are large compared to the time of passage of a nuclear dipole through the irradiation coil, then the nuclear spin system of the liquid essentially obeys the same laws as the nuclear moment of free molecules in the resonance field of a molecular beam resonance apparatus. (tr-auth)

6999

IONIZATION AND CHARGE EXCHANGE CROSS SECTIONS OF HYDROGEN ATOMS AND IONS AT 9 TO 60 kev IN HYDROGEN. Fred Schwirzke (Technische Hochschule, Karlsruhe, Ger.). Z. Physik 157, 510-22(1960). (In German)

The measurement of ionization and charge exchange cross sections for hydrogen atoms (H^0), protons (H^+), and molecular hydrogen ions H_2^+ and H_3^+ in hydrogen gas in the energy range 9 to 60 kev is described. Further, the emission of secondary electrons from copper–beryllium by impact of these particles was measured. A beam of monoenergetic neutral hydrogen atoms was produced by charge exchange of a beam of protons in a gas chamber. Separation of the charged and uncharged components was accomplished by a magnetic field. The pressure in the chamber in which the cross sections were measured was so low, that only a few particles of the incident beam suffered an effective collision. The positive and negative charges, which were produced by ionization and charge exchange along the path of the beam, were extracted by a transverse electric field and the saturation current was measured. The intensity of the neutral beam was determined at the same time by repeated charge exchange in an 80 mμ thick foil of aluminum oxide. (auth)

7000

RESONANCE SCATTERING OF GAMMA-QUANTA ON Cd^{114} NUCLEI. N. N. Delyagin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1177-82(1959) Nov. (In Russian)

The lifetime of the first excited state of the Cd^{114} nucleus (556 kev) was measured by the γ-quantum reso-

nance scattering method in which a gaseous In^{114} source in the compound $InCl_3$ was used. The value $\tau = (1.42 \pm 0.21) \times 10^{-11}$ sec for the lifetime of the level satisfactorily agrees with the data of Coulomb excitation investigations. The interrelationship between reduced transition probabilities for even-even cadmium isotopes and the excitation energy is discussed. (auth)

7001

THE (d,t)-REACTION ON C^{12}, F^{19}, AND Al^{27} NUCLEI. N. A. Vlasov, S. P. Kalinin, A. A. Ogloblin, V. I. Chuev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1187-92(1959) Nov. (In Russian)

The spectra and angular distributions of tritons produced in the reactions $C^{12}(d,t)C^{11}$, $F^{19}(d,t)F^{18}$, and $Al^{27}(d,t)Al^{26}$ for 20 Mev deuterons were measured on basis of the β radioactivity of tritium. The spins and parities of a number of states of F^{18} and Al^{26} were derived by comparing the triton angular distributions obtained with Butler's theory. The probability of excitation of levels of the residual nucleus sharply drops with increase of their energy. (auth)

7002

FORBIDDEN TRANSITIONS IN THE DEFORMED Tm^{169} NUCLEUS. E. E. Berlovich, V. N. Klement'ev, V. G. Fleisher, O. V. Larionov, F. Sh. Murtazin, and D. A. Apostolev (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1202-6(1959) Nov. (In Russian)

Lifetime values of $(3.6 \pm 0.1) \times 10^{-8}$ sec and $(6.7 \pm 0.2) \times 10^{-7}$ sec were obtained by delayed coincidence measurements for the 379 kev and 316 kev levels of the Tm^{169} nucleus. The partial probabilities for eight transitions were determined on the basis of these data and those on the relative transition intensities from both levels and the multipolarity ratios. For the 177 (E2), 177 (M1), 198 (E2), 198 (M1), 308 (E2), 240 (E1), and 260 kev (E1) transitions which are forbidden with respect to the projection of the total angular momentum on the deformation axis, the delay factor comprises 10^3 to 10^4 per unit forbiddenness, a value which differs significantly from the usual value (10 to 100). The 63 kev (E1) transition which is forbidden with respect to the projections of the orbital and spin momenta and also with respect to the quantum number characterizing oscillations along the deformation axis is less probable by five orders of magnitude than that predicted by Weisskopf's estimation. However it is in good qualitative agreement with Nilsson's calculation of the probability for deformed nuclei. (auth)

7003

CROSS SECTION FOR PRODUCTION OF Fm^{250} IN THE REACTIONS $Pu^{241}(C^{13},4n)Fm^{250}$ AND $U^{238}(O^{16},4n)Fm^{250}$. V. V. Volkov, L. I. Guseva, B. F. Myasoedov, N. I. Tarantin, and K. V. Fillippova. Zhur. Eksptl'. i Teoret. Fiz. 37, 1207-11(1959) Nov. (In Russian)

The cross section for production of Fm^{250} in the reaction $Pu^{241}(C^{13},4n)$ and $U^{238}(O^{16},4n)$ was determined as a function of the energy of the bombarding particles. Comparison of the cross section for production of Fm^{250} with the fission cross section in these reactions shows that in the overwhelming majority of cases the excited compound Fm^{254} nucleus undergoes fission, and only in a very few cases deexcitation takes place as a result of neutron emission. The maximal cross section for production of Fm^{250} by irradiation with oxygen or carbon ions is, respectively, 1×10^{-30} cm^2 and 5×10^{-30} cm^2. The difference between the cross sections is probably due to the effect of the Coulomb barrier. (auth)

7004

ISOTOPIC MASSES AND BINDING ENERGIES OF NUCLEI FOR MASSES BETWEEN 186 AND 196. R. A. Demirkhanov, T. I. Gutkin, and V. V. Dorokhov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1217-24(1959) Nov. (In Russian)

Values of the masses and binding energies are presented for the nuclei of osmium, iridium, platinum, gold, and mercury isotopes. The masses were measured on a mass spectrograph possessing a resolving power of 60000 to 80000. The isotope masses were derived from doublets by direct comparison with the masses of corresponding organic compounds. The masses of 18 stable isotopes were measured and the masses of 18 radioactive isotopes were computed. The data thus obtained were used to evaluate the binding energy of nuclei, the binding energy per nucleon (E/A), the binding energies of the last neutron and proton (B_n and B_p), and the pair energies of neutrons and protons (P_n and P_p). For N = 116 the binding energy of nuclei was found to vary in a nonmonotonous manner for even as well as odd values of Z. (auth)

7005

EFFECT OF TEMPERATURE ON THE VARIATION OF THE ISOTOPIC COMPOSITION OF LIQUID MERCURY IN THE ELECTRIC FIELD OF A CONSTANT CURRENT. I. V. Bogoyavlenskii, V. N. Grigor'ev, and N. S. Rudenko (Inst. of Physics and Tech., Ukrainian Academy of Sciencs, SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1241-6(1959) Nov. (In Russian)

An experimental study was made of the temperature dependence of the change in the concentration of liquid mercury isotopes upon passage of a constant electric current through the liquid. In the stationary case the change in the concentrations was found to be independent of temperature. Some possible mechanisms of the phenomenon are discussed. (auth)

7006

EMITTERS OF α PARTICLES WITH ENERGIES OF ABOUT 9 AND 12 Mev. V. A. Karnaukhov, V. I. Khalizev, and G. N. Flerov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1266-72 (1959) Nov. (In Russian)

Lead was irradiated with accelerated oxygen and carbon ions. Isotopes emitting 11.8 ± 0.4 and 9.0 ± 0.3 Mev particles with half life periods of approximately 1 min and 35 ± 10 sec, respectively, were detected among the reaction products. Some ideas concerning the identification of the isotopes are discussed. (auth)

7007

ELASTIC SCATTERING OF 5 to 22 Mev π^+ MESONS ON CARBON. V. G. Kirillov-Ugryumov, L. P. Kotenko, E. P. Kuznetsov, F. M. Sergeev, and A. F. Grashin. Zhur. Eksptl'. i Teoret. Fiz. 37, 1273-80(1959) Nov. (In Russian)

Elastic scattering of 5 to 22 Mev π^+ mesons on carbon in a propane bubble chamber was investigated. A phase shift analysis of the argular distributions shows that a repulsive potential acts on the meson in the S state in the nucleus. (auth)

7008

FRAGMENTATION ON BISMUTH NUCLEI. V. F. Darovskikh, N. P. Kocherov, and N. A. Perfilov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 1292-5(1959) Nov. (In Russian)

Fragmentation on bismuth nuclei induced by 660 Mev protons was studied by imbedding small bismuth particles in a nuclear emulsion. Data were obtained on the cross section for the process, angular distribution of the frag-

ments (forward-backward ratio), and the charge and energy distribution of multi-charged particles. (auth)

7009

SCATTERING OF ELECTRONS BY LIGHT NONSPHERICAL NUCLEI. E. V. Inopin and B. I. Tishchenko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zhur Eksptl'. i Teoret. Fiz. 37, 1308-18(1959) Nov. (In Russian)

Scattering of electrons on nonspherical nuclei is treated in the Born approximation. Expressions for the elastic and inelastic scattering cross sections were derived in the general case of oriented nuclei possessing arbitrary deformations. The theory is compared with experiments on inelastic scattering of electrons by light nuclei. (auth)

7010

THRESHOLD MOMENTUM POWER SERIES EXPANSION OF THE AMPLITUDE OF A REACTION INVOLVING THE FORMATION OF LOW ENERGY PARTICLES. I. T. Dyatlov (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1330-6(1959) Nov. (In Russian)

It is demonstrated that the linear terms and the quadratic terms of the threshold momenta power series expansion of the amplitude of an arbitrary process near the threshold which specify the angular distributions can be obtained by considering the analytical properties of the amplitude. (auth)

7011

EXCITATION OF VIBRATIONAL LEVELS IN NUCLEI BY CHARGED PARTICLES. A. D. Pliy (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1434-40(1959) Nov. (In Russian)

Excitation of the first vibrational level of an even-even nucleus by charged particles possessing energies close to the height of the Coulomb barrier is considered. (auth)

7012

THE RATIOS OF TRANSITIONS TO THE PRIMARY EXCITED LEVELS OF DAUGHTER NUCLEI IN U^{238} AND U^{234} DECAY. A. A. Vorob'ev, A. P. Komar, and V. V. Korolev (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1456-7(1959) Nov. (In Russian)

The ratios of transitions to primary excited levels were measured with a pulse ionization chamber in coincidence with a NaI crystal scintillation counter. The α spectrum of a natural uranium isotopic mixture measured in coincidence with x rays (L) shows that the number of U^{234} transitions to the first level of Th^{230} was $N_1 = 1815$; for U^{238} transitions to the first level of Th^{234} $N_2 = 1640$; ~30 pulses from U^{235} should be substracted from N_2. With corrections for L_{II} and L_{III} conversion line distortions and M and O shell conversions, the transition ratio $N_2/N_1 = 0.91 \pm 0.04$. (R.V.J.)

7013

ANGULAR DISTRIBUTIONS OF α PARTICLES IN REACTION $C^{12}(p,p',3\alpha)$. S. S. Vasil'ev, V. V. Komarov, G. V. Koshelyaev, and A. M. Popova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1460-1(1959) Nov. (In Russian)

The angular distribution of α particles from C^{12} bombardment by 22 ± 1 and 29 ± 1 Mev protons indicates the presence of direct $p-\alpha$ interactions at 29 Mev. Also, some events of such interactions were observed at 22 ± 1 Mev. (R.V.J.)

7014

MEASUREMENTS OF ANGULAR DISTRIBUTIONS OF NEUTRONS, ELASTICALLY SCATTERED ON He^3. A. I. Abramov. Zhur. Eksptl'. i Teoret. Fiz. 37, 1476-8(1959) Nov. (In Russian)

A miniature spherical ionization chamber filled with 25% He^3 and 75% Ar up to 11 atm. was used for measuring neutron distributions from elastic scattering by He^3. The measurements were made at 1000, 1400, 1800, 2000, 2770, and 4480 kev, using neutrons from the reaction $T^3(p,n)$ for the last two. A standard linear amplifier and 128-channel amplitude analyzer with a ferrite memory computer were used for measuring pure spectra of recoil nuclei (cleared of the (n,p) reaction pulses) and for plotting the angular distributions. (R.V.J.)

7015

INVESTIGATIONS ON SOME EVEN-EVEN NUCLEIDES. PROPERTIES OF THE SECOND EXCITED STATE. Raafat Kamel Girgis. Thesis, Universiteit, Amsterdam, 1959. 158p.

The energy level schemes and the branching ratios from the second excited 2^+ state were investigated in the even-even nuclides: Ge^{74}, Se^{78}, Pd^{104}, Cd^{112}, Sn^{116}, Te^{114}, Ba^{134}, and Ba^{136}. The relative intensities of gamma rays following the decay of Rb^{84}, I^{126}, and I^{128} are reported. Experimental arrangements and methods of analysis of complex gamma spectra by gamma and beta spectrometers and coincidence techniques are described. (C.J.G.)

7016

MEANS FOR TESTING MATERIALS. (to United Kingdom Atomic Energy Authority). British Patent 817,571. Aug. 6, 1959.

A means is described for measuring neutron absorption in graphite or other moderating materials. The graphite, in the form of a cylinder or sphere is pierced with holes for introduction of a neutron source and in foil detectors to measure the neutrons at 45 locations in the material. A Cd shield can be removed or replaced to allow measurements with and without thermal neutrons being involved. (T.R.H.)

7017

IMPROVEMENTS IN OR RELATING TO FISSION PROCESSES. Giovanni Battista Tommasi. British Patent 818,232. Aug. 12, 1959.

A theory and model of the nucleus is described in which a particular nuclear configuration is pointed out as being suitable for fissionable material. According to the invention, Sm^{144} and other isotopes of the desired configuration may be used as reactor fuel with or without U or Pu. (T.R.H.)

Particle Accelerators

7018 AECU-4628

Stevens Inst. of Tech., Hoboken, N. J.

SOME DESIGN CONSIDERATIONS FOR THE MEGATRON COIL. Ronald W. Landau. Nov. 1959. 21p. Project No. DA-3-99-06-108. Contracts AT(30-1)-2410 and DA-36-039-SC-78097. OTS.

The relation between the maximum permissible transverse energies of particles that can be focused, the azimuthal energy, and the beam width is discussed relative to Megatron coil design. It is shown that deep potential wells for focusing can be obtained only at the expense of a narrow beam. (C.J.G.)

7019 AERE-R-3013

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ACCEPTANCE OF AXIALLY AND RADIALLY OSCILLATING PARTICLES IN THE LINAC INJECTOR FOR THE

HARWELL 7 GEV PROTON SYNCHROTRON (NIMROD). R. Taylor. Oct. 1959. 34p. BIS.

Results are presented of calculations made on the ranges of input particle energies, phases, and divergences from the axis which would be accepted by the linac. The phase-energy acceptance diagram for particles moving on the axis is an irregularly shaped area lying mainly between 105 and 220° in phase, and between 520 and 710 kev in energy. The linac will accept radially oscillating particles whose initial radii and divergences lie within an ellipse whose axes correspond to a beam diameter of 1 cm and a divergence of 1.5°. (W.D.M.)

7020 DESY-A-1.7

Deutsches Elektronen-Synchrotron, Hamburg.

GESAMTANLAGE DES VERMESSUNGSSYSTEMS. (Complete Installation of the [Alignment] Measurement System). M. Kneissl. Sept. 29, 1959. 15p.

The German Electron Synchrotron consists of 48 magnets which form an acceleration ring with a predetermined radius of 50.42m. The mean deviation from this ideal radius should not exceed ±0.1 mm vertically or horizontally. The basic figure of the measurement installation to assure this accuracy is selected to be an octagon. The advantages to be gained by an octagon shape are discussed. In the construction of the measurement posts the effects of temperature variations must be eliminated, and the posts must have the same height and be precisely placed. Inner wires and tapes are used for spacing measurements. The adjustment and testing of the magnets are described and discussed. Height measurements are briefly considered. (J.S.R.)

7021 DESY-A-1.8

Deutsches Elektronen-Synchrotron, Hamburg.

DAS VERMESSUNGSSYSTEM FÜR DAS DEUTSCHE ELEKTRONEN-SYNCHROTRON, HAMBURG. (The [Alignment] Measurement System for the German Electron Synchrotron, Hamburg). Sept. 22, 1959. 45p.

The alignment system of the DESY electron synchrotron was planned in detail. The basic figure of the system is an octagon. The coordinate indices for the surveying points were obtained. The surveying instruments are described. The octagon is considered in detail with a discussion of marking and measurement and equalization of the measurements in the octagon. The error equations are derived and corner points are placed. The placement of the intermediate measurement posts is discussed. The position of the concrete ring is inspected by geodetic means, and the values characterizing the accuracy of the method are determined. The system to determine the adjustment, placing, and position monitoring of the magnets is described. (J.S.R.)

7022 INSJ-23

Tokyo Univ. Inst. for Nuclear Study.

ON THE EXTERNAL PROTON BEAM OF ABOUT 55 MeV OF THE INSJ 160 CM SYNCHROCYCLOTRON. A. Suzuki, S. Suwa, Y. Sazi, T. Karasawa, T. Yamada, Y. Miyazawa, and J. Sanada. Dec. 17, 1959. 12p.

The INSJ 160-cm cyclotron can be used both as a fixed frequency variable energy cyclotron and as a frequency-modulated synchrocyclotron. The intensity, the energy, and other properties of its external proton beam in the synchrocyclotron case are described. It has been confirmed that this cyclotron works well also as a synchrocyclotron with a high intensity of the extracted beam. (auth)

7023 NP-8212

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

VYSOKOCHASTOTNYI ISTOCHNIK IONOV. DOKLAD NO. 96/I-A. (High Frequency Ion Source. Report No. 96/I-A). L. Bobrovskii, E. Garskii, A. Martsinkovskii, and M. Yaskula. July 1959. 13p.

A high-frequency ion source for an electrostatic Van De Graaff accelerator was constructed. The optimum height of the projection of the quartz cylinder over the cathode was found to be S = 3.6 mm with cathode dimensions L = 15 mm, d = 1.6 mm, and D = 4.5 mm. The relationship of the ion current to the feed power of the generator and voltage extraction was investigated. The ratio of the focused ions as a function of voltage extraction was studied for various generator powers. At 320 w power, 48 hertzian frequency, and 3 kv output, the maximum ion current of the source consists of 430 amp. The total expenditure of hydrogen does not exceed 2 cm^2/kv. (tr-auth)

7024 NP-8236

Instituto de Alta Cultura. Centros de Estudos de Energia Nuclear. Laboratorio de Fisica Nuclear, Oporto, Portugal.

A NEW ELECTROSTATIC ACCELERATOR? Technical Paper No. 21. Manuel José de Campos Costa. 1959. 32p.

An electrostatic generator different from the Van de Graaff and the Pauthenier system because it employs an insulating liquid as carrying vehicle for the electric charges replacing the belt and the gas current employed in these two well known generators is described. Some experimental values are presented, and a simple experiment is described where about 200 kv and 2.5 μa in the short-circuit current were obtained. Some values that will be useful to the building of a new model with which it is hoped to obtain about 600 kv are determined. The short-circuit currents of the three generators are compared, and it is concluded that they are proportional to the dielectric constant of the ambient that involves the electric charges in the system that carries them to the H.V. electrode and which is, after all, the key to the problem of these systems. (auth)

7025 ORNL-2860

Oak Ridge National Lab., Tenn.

THE ADMITTANCE AND TRANSFER FUNCTIONS OF SOLID CORE ELECTROMAGNETS (thesis). N. F. Ziegler. Jan. 18, 1960. 55p. Contract W-7405-eng-26. OTS.

Submitted to the Univ. of Tennessee.

The admittance and transfer functions of large, solid-core electromagnets were determined. The effects of eddy currents and hysteresis were considered in deriving the functions. The study was concerned with the type of magnet employed in nuclear physics research which requires very precise regulation of the magnetic field. The study originated during the design of an analyzing magnet regulator for the ORNL 63-inch cyclotron. (W.D.M.)

7026 PIB-710

Brooklyn. Polytechnic Inst. Microwave Research Inst.

INVESTIGATION OF A CIRCULAR WAVEGUIDE PERIODICALLY LOADED WITH STRAIGHT WIRES. Research Report R-782-59. M. Ettenberg and T. Tamir. Oct. 15, 1959. 16p. Contract AF18(600)-1505. (AFOSR-TN-59-1298).

The investigation of the properties of a periodically loaded line is described. This line, consisting of a circular guide with straight wires loading, is shown to be suitable for linear accelerators and traveling-wave tubes. The determination of the propagation characteristic and other pertinent measurements are described. The results show that the structure exhibits a fundamental slow backward harmonic, similar to the properties of an anti-Karp line. A discussion on the influence of various parameters indi-

cates how an appropriate propagation curve may be designed by suitably proportioning the geometrical dimensions of the structure. (auth)

7027 UCRL-Trans-508

THE FORMATION OF AXIALLY-SYMMETRIC MAGNETIC FIELDS. V. I. Danilov, N. L. Zaplatin, V. S. Rybalko, and L. A. Sarkisian. Translated for Univ. of California Radiation Lab. from a report of the Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems, 1959. (P-344). 28p. JCL or LC.

The formation of axially symmetric magnetic fields for accelerators by use of ring shims is considered. Magnetic field components of ring shims are examined, and calculations based on the assumption that the shim volume is uniformly magnetized in the direction of the vertical component of the outer magnetizing field are presented. Calculations and experimental data indicate that results obtained by this method for the magnetic field of ring shims are correct to about 3 to 8%. (J.R.D.)

7028 UCRL-Trans-509

FORMING THE MAGNETIC FIELD OF A CYCLOTRON WITH A SPACE VARIATION. V. I. Danilov, V. P. Dmitrievskii (Dmitrievskiy), N. L. Zaplatin, V. V. Kol'ga, Lyu Ne-chuan's, V. S. Rybalko, and L. A. Sarkisyan. Translated for (Univ. of California Radiation Lab.) from a report of the Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems, 1959. (P-373). 30p. JCL or LC.

Formation of the magnetic field in spiral cyclotrons where the field is formed by a system of spiral and annular shims is examined. The magnetic field of this system is calculated assuming that the volume of the shims is homogeneously magnetized in the direction of the vertical component of the external magnetizing field. Preparation of the spiral shims is discussed along with constructional features of the electromagnet pole pieces. (J.R.D.)

7029 UCRL-Trans-510

CYCLOTRON WITH SPATIAL VARIATION IN THE INTENSITY OF THE MAGNETIC FIELD. D. P. Vasilevskaya, A. A. Glazov, V. I. Danilov, Yu. N. Denisov, V. P. Dzhelepov, V. P. Dmitrievskii, B. I. Zamolodchikov, N. L. Zaplatin, V. V. Kol'ga, A. A. Kropin, Liu Ne-chuan, V. S. Rybalko, A. L. Savenkov, and L. A. Sarkisyan. Translated for Univ. of California Radiation Lab. from Report of Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems, 1959. (P-390). 43p. JCL or LC.

Problems connected with the development of cyclotrons with spatial variations in the magnetic field intensity are considered. The linear theory of charged particle movement in the magnetic field with a periodic structure along the radius and the azimuth is examined. Theoretical and experimental results of a non-linear resonance study near the center of the accelerator are given. Formulas for calculating the required configurations of the magnetic fields are obtained. Methods of shimming, measuring, and stabilizing the magnetic field are explained. The system of ion acceleration, the ion source, and the vacuum chamber of the accelerator are described. A developed accelerator with the diameter of pole tips of 120 cm. was used for modeling the phase movement of ions and studying space stability, in which, deuterons are accelerated to the energy of 13 Mev at the amplitude of accelerating potential of 5 kv. (auth)

7030

THE VACUUM SYSTEM OF THE RING CHAMBER OF THE CERN 25-BEV PROTON SYNCHROTRON. R. A. Haefer and G. Zinsmeister. Atomwirtschaft 4, 528-32(1959) Dec. (In German)

The vacuum system of the ring chamber of the CERN proton synchrotron was designed to fulfill two main demands: the production of an adequate vacuum and the provision of adequate operational reliability. A vacuum tight Ni-Cr alloy which gives off little gas was chosen for the chamber material. Sixty-eight entirely independent three-stage fractionating oil diffusion pumps are distributed symmetrically round the circumference of the chamber. Each pump has its own control and safety system. The monitoring arrangements make the evacuation process fully automatic. (auth)

7031

THE INFLUENCE OF FRINGING ON BETATRON OSCILLATIONS IN AN ACCELERATOR WITH A SECTIONED MAGNET. [PART] I. Jiří Teichman (Research Inst. of Vacuum Electronics, Prague). Czechoslov. J. Phys. 9, 47-66(1959). (In Russian)

A study is made of betatron oscillations in stray fields at the edges of the magnets of an accelerator having a small radius. Two approximations of the course of stray fields, chosen on the basis of measurements, help in the construction of non-linear equations of motion of the particle. Transformation matrices of the boundary regions are derived. The case when an equilibrium trajectory encloses a general angle with the edge of the magnet is also treated. (auth)

7032

ION ACCELERATOR. John Stewart Bell (to U. S. Atomic Energy Commission). U. S. Patent 2,904,720. Sept. 15, 1959.

An arrangement for the drift tubes in a linear accelerator is described whereby each drift tube acts to shield the particles from the influence of the accelerating field and focuses the particles passing through the tube. In one embodiment the drift tube is split longitudinally into quadrants supported along the axis of the accelerator by webs from a yoke, the quadrants, webs, and yoke being of magnetic material. A magnetic focusing action is produced by energizing a winding on each web to set up a magnetic field between adjacent quadrants. In the other embodiment the quadrants are electrically insulated from each other and have opposite polarity voltages on adjacent quadrants to provide an electric focusing field for the particles, with the quadrants spaced sufficiently close enough to shield the particles within the tube from the accelerating electric field.

Plasma Physics and Thermonuclear Processes

7033 AERE-R-2917

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ON THE STABILITY OF F. B. KNOX'S SPHERICAL PLASMA. R. T. P. Whipple. June 1959. 47p. BIS.

A method has been proposed by F. B. Knox for containing plasma at the center of a spherical cavity by means of radiation pressure, using three sets of H_1 waves centered about three mutually perpendicular axes. If the amplitudes are equal and the frequencies sufficiently different to prevent interference effects then the time mean pressure excited on a concentric spherical conducting plasma is uni-

form over its surface. Assuming that the surface of the plasma is slightly distorted, the resulting surface radiation pressure distribution is investigated. (W.D.M.)

7034 AFCRC-TN-59-787

Stanford Univ., Calif. Microwave Lab.

INTERPRETATION OF THE RESULTS OF THE RF CONFINEMENT EXPERIMENT. Scientific Report No. 3. P. A. Sturrock. Oct. 1959. 30p. Project No. 47501. Contract AF19(604)-5226. (ML-638). OTS.

The results of certain experiments upon the confining action of low frequency (about 10 Mc/sec) rf fields upon plasmas are reviewed. Attempts at a theoretical explanation of these results by various confinement mechanisms also are reviewed. The theories are not found acceptable, and reasons are given for believing that the experiments do not represent true confinement. Investigation of the electric field configuration necessary to explain the observed plasma configuration leads one to interpret the experiment in terms of "pseudo-confinement." Surface charges build up on the inner wall of the glass tube in such a way that electrons experience a radially inward force at the surface of the plasma over almost all of the surface of the plasma almost all of the time; ions therefore experience an outward force almost everywhere most all of the time. The effect of the rf electric field is therefore to promote the formation of a high-voltage sheath separating the plasma from the glass tube. This interpretation appears to be fully compatible with observations so far made with various electric-field patterns. It also offers an explanation of the dark deposits on the glass tube noted in certain experiments. Further experiments which may be conducted to verify this theory are proposed. (auth)

7035 LAMS-2371

Los Alamos Scientific Lab., N. Mex.

PARTICLE ORBITS IN A ROTATING MAGNETIC FIELD. Bergen R. Suydam. Oct. 1959. 11p. Contract W-7405-eng-36. OTS.

Magnetic fields rotating at a radio frequency have been proposed as a possible method for confining a plasma. For this reason it was felt desirable to obtain some information on the effects of field rotation on a plasma. As a step in this direction, the orbit of a charged particle in a rotating magnetic field is determined. (auth)

7036 NP-8235

[Borg-Warner Corp. Research Center, Des Plaines, Ill.]

A PULSED PLASMA SYSTEM—AN ADVANCED REACTION PROPULSION SYSTEM. Interim Progress Report [for] September 1, 1959 to December 31, 1959. Jan. 4, 1960. 26p. Project No. 3148. Contract AF33[616]-6036. (R-12-3148).

The main effort was devoted to improving and building up instrumentation in order to obtain more complete measurement of the parameters of interest. Various probes were constructed and installed to provide a scope trigger, to display the wave form of the discharge current, to measure the plasma velocity, and to determine the distribution of charge in the plasma. Results of the analog computer solutions of the differential equations are presented. These results give at least the qualitative relation between specific impulse, efficiency, and thrust. (W.D.M.)

7037 NP-8256

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

ELECTROMAGNETIC RADIATION FROM AN IONIZED HYDROGEN PLASMA. S. M. Berman. Sept. 24, 1959. 27p. (PRL-9-27).

An account is given of the radiant energy emitted by a hydrogen plasma in the temperature range from 0.7 to 9.0 ev due to the processes of recombination of electrons and protons, bound-bound transitions of excited H atoms, and bremsstrahlung of free electrons. It is assumed that, during the time that radiant energy is escaping, there will be enough collisions to maintain the plasma in thermodynamic equilibrium. In this case the population of excited states will be given by the usual Boltzmann factor. (W.D.M.)

7038 NP-8273

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

PLASMA OSCILLATIONS OF A CONFINED ELECTRON GAS. Erich S. Weibel. July 30, 1959. 20p. Contract AF04(647)-309. (TR-59-0000-00769).

The plasma oscillations of an electron gas which is confined by the potential $\phi = \frac{1}{2} m \omega_0^2 x^2$ are investigated using the Boltzmann transport equation without the collision term. This equation is linearized about the equilibrium distribution $f_0 = \exp(-1/kT)(\phi + \frac{1}{2} mv^2)$. By expanding the electric field in Hermite polynomials, it is possible to reduce the problem to determining the solutions of an infinite system of linear homogeneous equations for the coefficients of the expansion. Approximate solutions for the lowest two resonant frequencies are found analytically as the roots of a small sub-determinant. (auth)

7039 USCEC-56-209

University of Southern California, Los Angeles. Engineering Center.

DIFFUSION OF A FULLY IONIZED GAS CONFINED IN A STRONG MAGNETIC FIELD. Toyoki Koga. Dec. 30, 1959. 36p. Contract AF18(603)-95. (AFOSR-TN-59-1162).

Transport phenomena of a fully ionized gas in the presence of a strong magnetic field are treated. It is shown that there is a certain domain in the density-temperature space where the Boltzmann equation is valid. The mean free path is assumed to be longer than the mean Larmor radius. An average of the Boltzmann equation is made along a circular trajectory of gyrating particles. By this method of coarse-graining, the Boltzmann equation is reduced to the equation of diffusion. It is not assumed that the distribution function is close to the Maxwell function. A special case of constant energy per particle is treated in detail. The effect of the collisions between similar particles is negligible, and the ions and electrons diffuse almost at the same velocity. It is easily possible to apply the method to more general cases. (auth)

7040 AEC-tr-3699

ELECTROMAGNETIC WAVES IN PLASMAS. (Ondes Electro Magnetiques dans les Plasmas). T. Consoli. Translated for Oak Ridge National Lab. from French Atomic Energy Commission Report (CENS/PA/RT-1) of June 17, 1958. 7p. JCL.

The study of the general case of an electromagnetic wave being propagated in a medium of resistivity other than zero in the presence of a constant magnetic field is considered. The interest in calculations which are carried out starting from the base equations established by Spitzer and from similar hypotheses is to generalize and make more explicit the results given previously in following a method descending from the general to the particular cases. (W.D.M.)

7041

PRODUCTION OF HIGH-FREQUENCY PLASMOIDS STABLE AT THE RESONANCE FREQUENCY OF PLASMA. Richard Geller. Compt. rend. 249, 2749-51(1959) Dec. 21. (In French)

High-frequency plasmoids were obtained which were stable at densities $n \cong 10^7$ electrons/cm^3 and temperatures ~10^{5}°K. It was established that n corresponds to a value such that the high-frequency excitation can maintain the electronic resonance of the plasmoid of which the oscillation is given by $\omega_0 = \sqrt{4\pi ne^2/m}$. (tr-auth)

7042

THE INFLUENCE OF ANODE MATERIAL ON THE FORMING OF A POSITIVE COLUMN IN A GLOW DISCHARGE. Karel Šobra (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechslov. J. Phys. 8, 614-15(1958). (In Russian)

The influence of anode material on the current density of a positive column in glow discharge was investigated. It was revealed that the ionization force in the positive column is not affected by outside material, and is stabilized in such a way that each atom on the anode carries identical discharge current. (R.V.J.)

7043

EXPERIMENTAL VERIFICATION OF THE THEORY OF THE SUCCESSIVE PRODUCTION OF STRIATIONS IN A GLOW DISCHARGE. Luděk Pekárek (Inst. of Physics, Czechoslovak Academy of Science, Prague). Czechoslov. J. Phys. 9, 67-77(1959). (In English)

The properties of the stratification wave in the plasma of the positive column in a glow discharge in neon are measured. The measurements are compared with the results of the theory of the successive production of striations and good agreement is found. (auth)

7044

A NOTE ON THE THEORY OF THE SUCCESSIVE PRODUCTION OF MOVING STRIATIONS IN THE PLASMA OF INERT GASES. Miloš Novák (Inst. of Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 78-83(1959). (In Russian)

Approximate expressions are derived on the basis of Pekárek's theoretical paper for the period of the maximum t_B of a wave packet produced by the passage of a wave of stratification before the aperture of a photomultiplier, and for its time width in the half-height Δt_B. The relaxation time of a wave of stratification can be calculated by means of the experimentally measured velocity of motion of the maximum of a wave packet u and its width Δt_B. The calculation is supplemented by numerical data on the magnitude of errors committed by using approximate expressions. (auth)

7045

A CONTRIBUTION TO THE STUDY OF ELECTRODE SPACES OF HIGH-CURRENT SHORT-DURATION ELECTRIC DISCHARGES. Vladimir Hermoch (Inst. of Mechanical Physics, Czechoslovak Academy of Sciences, Prague). Czechoslov. J. Phys. 9, 84-90(1959). (In Russian)

The electrode spaces of high-current short-duration discharges are analyzed using the method of artificial contraction (limiting of the active surface of the electrodes). It was shown that evaporation of the electrodes during the discharge can be regarded as one of the main factors causing thermal contraction of the channel on the surface of electrodes and high-current density on the electrodes and enabling the independent existence of partial spots. (auth)

7046

THE INFLUENCE OF A HF FIELD ON THE HOMOGENEOUS POSITIVE COLUMN OF A DC GLOW DISCHARGE. Milos Sicha (Charles Univ., Prague). Czechoslov. J. Phys. 9, 124-7(1959). (In Russian)

The data show lamination of the positive column, starting at the discharge superposition point and extending in the direction of the anode. A similar lamination was revealed by B. N. Klyafel'd (JETP, 22, 66, 1950) by placing diaphragms or probes in front of a discharge or by introducing an auxiliary transverse constant discharge. The disturbance produced by high-frequency discharge affects the positive column lamination. (R.V.J.)

7047

INCREASE IN BREAKDOWN POTENTIAL OF A GAS IN ELECTRODELESS DISCHARGE IN THE PRESENCE OF A TRANSVERSE MAGNETIC FIELD AND THE CONCEPT OF EQUIVALENT PRESSURE. S. N. Goswami (Central Calcutta Coll.). Indian J. Phys. 33, 405-6(1959) Sept.

The properties of electrical discharges were previously investigated in the presence of a uniform transverse magnetic field. It is pointed out that the concepts of equivalent pressure and of increased breakdown potential are fundamentally the same. (B.O.G.)

7048

MEASUREMENT OF THE TEMPERATURE OF A HIGH-FREQUENCY DISCHARGE WITH HYDRAULIC COMPRESSION. Zh. Zheenbaev (Lomonosov State Univ., Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 44-9(1959) Dec. (In Russian)

Temperature measurements of high-frequency discharge with hydrodynamic compression are described. The discharge is used as the light source for the spectral analysis of solutions. It is shown that hydrodynamic stabilization of the discharge results in a sharp increase of temperature and creates conditions for the establishment of thermal equilibrium. In the present case, as shown by the measurements, the temperature was 7000°K. Moreover, the form of high-frequency discharge was quite stable during prolonged combustion of the discharge. (auth)

7049

PLASMA HEATING BY CURRENT-SATURATION. K. A. George (Tata Inst. of Fundamental Research, Bombay). Nature 184, Suppl. 23, 1790(1959) Dec. 5.

During attempts to produce high-temperature plasma in a toroidal discharge by means of large induced currents it was noted that acceleration of ions takes place as indicated by the anisotropy of neutron distribution and by the Doppler shift of spectral lines. Ion acceleration was found to be possible when the ion-electron collision cross section became small, a condition which sets in when the electrons begin to run away. Methods for estimating the runaway condition are discussed. It is suggested that the process which produces runaway ions may be exploited to increase the energy density of the plasma even though such a plasma is not in thermodynamic equilibrium. (C.H.)

7050

BUILDUP OF A DISCHARGE IN ARGON. M. Menes (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 116, 481-6(1959) Nov. 1.

Measurements were made of the rate of buildup of an electrical discharge in argon in the pressure range from 5 to 60 cm Hg. The results are interpreted on the basis of a secondary mechanism due to delayed photons. The photon delay times which fit the observed data are in the neighborhood of five microseconds over the range of pressures investigated. These photon delay times are compared with (a) calculated imprisonment times for resonance radiation, and (b) delay times for molecular radiation as observed by Colli. Considering the uncer-

tainty in the calculations and the lack of knowledge about the energy distribution between the two main resonance lines, the imprisonment times are of the right magnitude to explain the observed buildup rates. The Colli-process delay times are in fair agreement with the data at the higher pressures; at the low pressures they are definitely too slow to explain the observed buildup rates. (auth)

7051

TRANSPORT PHENOMENA IN SLIGHTLY IONIZED GASES: LOW ELECTRIC FIELDS. Mahendra Singh Sodha (Armour Research Foundation, Chicago). Phys. Rev. 116, 486-8(1959) Nov. 1.

Chapman and Cowling have obtained the velocity distribution function of electrons in a slightly ionized gas when an electric field E is applied by assuming elastic collisions and validity of Lorentzian approximation. The author has expanded this distribution function, neglecting terms involving fourth and higher powers of field and used this expansion to calculate various transport properties, when a magnetic field is also applied. To simplify mathematics the relaxation time was taken as a power function of electron velocity. Some approximations were discussed. It is seen that at low electric fields the transport properties can be expressed as linear functions of E^2. (auth)

7052

HYDROMAGNETIC WAVES IN A COMPRESSIBLE FLUID CONDUCTOR. John Carstoiu (Sylvania Electronic Systems, Waltham, Mass.). Proc. Natl. Acad. Sci. U. S. 46, 131-6 (1960) Jan.

An infinite mass of an electrically conducting fluid at rest, penetrated by a uniform magnetic field, was considered. The possibility of propagation along the lines of force of the undisturbed magnetic field, in opposite directions, was demonstrated by Alfvén. This problem is approached from the vorticity field and current density point of view. Equations are derived for these components in the direction of the magnetic field only and propagation is made in the Alfvén manner. (B.O.G.)

7053

PLASMA ELECTRON RESONANCE. M. D. Gabovich and L. L. Pasechnik (Inst. of Physics, Academy of Sciences, Ukrain. SSR). Radiotekh. i Elektron. 4, 1850-53(1959) Nov. (In Russian)

Descriptions are given of a plasma electron resonance observed in the modulated electron beam interaction with independently formed plasma. (tr-auth)

7054

DEIONIZATION TIME OF RAREFIED HELIUM IN MAGNETIC FIELD. PART I. A. S. Syrgiy and V. L. Granovskii (Lomonosov Moscow State Univ.). Radiotekh. i Elektron. 4, 1854-60(1959) Nov. (In Russian)

The rate of rarefied helium deionization was determined by oscilloscopic measurements of ion flow to the negative probe in disintegrating plasma. Effects of magnetic field induction (from 0 to 1500 gauss) on deionization time constants and the transverse ambipolar diffusion factor in He were determined. (R.V.J.)

7055

INVESTIGATIONS ON CATHODE THERMOLUMINESCENCE. [PART] I. Dietrich Hahn and K. Lertes (Physikalisch-Technische Bundesanstalt, Berlin). Z. Physik 156, 425-35 (1959). (In German)

New investigations of the temperature dependence of the cathode luminescence in stationary excitation show that the occurrence of maxima, similar to those in glow measurements, in the warming of the phosphors occurs by a variation of the beam density of the exciting electrons. This beam density variation with temperature is a result of the pressure oscillations in the tube caused by the condensation and adsorption of gases and vapor on the luminescent materials or the walls. The emission capacity of the cathode is therefore modified; it is shown that oxide cathodes are more susceptible than tungsten cathodes. By improvement of the vacuum to 10^{-6} Torr total pressure, this effect is eliminated completely in grease-proof vacuum vessels. This was indicated by simultaneous measurement of the anode current, pressure, and luminescence (which then proceed regularly). (tr-auth)

7056

DIFFUSION-DETERMINED FIELD INSTABILITIES IN GASES WITHIN THE STATIC BREAKDOWN FIELD STRENGTH. H. Rother (Physikalisch-Technischen Institut der Deutschen Akademie der Wissenschaften, Berlin). Z. Physik 157, 326-34(1959) Nov. (In German)

In gases in which electrons accumulate with sufficient probability on the basic-gas atoms during negative-ion formation, space-charge fields are built up by sufficiently high field strengths according to the Poisson equation and diffusion equations (carrier-balance and energy-balance). These space-charge fields can exceed the adjacent outer electric field by a multiple. A local disturbance of carrier concentration, field, or electron temperature no longer fades out, but moves under constant amplification to the anode. These field increases should be able to activate the process of electric breakdown by external field strengths which still lie substantially within the Townsend breakdown voltage. Effects such as the lowering of breakdown, for example in pure N_2, by addition of a trace of electrons to refined gas up to 50% may be due to such field instabilities, likewise the deviation from the Paschen Law at high pressures. (tr-auth)

7057

OSCILLATIONS OF AN INHOMOGENEOUS PLASMA IN A MAGNETIC FIELD. L. I. Rudakov and R. Z. Sagdeev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1337-41(1959) Nov. (In Russian)

Small oscillations of a hot plasma confined by the pressure of a magnetic field are treated with aid of the kinetic equation in the "drift" approximation without the collision integral. Two types of waves can exist for the wave vector lying in a plane perpendicular to the direction of the unperturbed magnetic field. One of these is a slow (drift) wave with a propagation velocity of the order of the mean electron (ion) drift velocity in the unperturbed state and the other is a magnetoacoustic wave. The first type of wave is characteristic only of an inhomogeneous plasma. For a certain interdependence between the zero magnetic field gradients, plasma density, and plasma temperature, the drift current in the unperturbed plasma may lead to amplification of such oscillations. The criteria for instability of this type were obtained. (auth)

7058

ON EQUILIBRIUM OF A PLASMA UNDER HELICAL SYMMETRY. B. B. Kadomtsev. Zhur. Eksptl'. i Teoret. Fiz. 37, 1352-4(1959) Nov. (In Russian)

A simple example of plasma equilibrium in a magnetic field with helical symmetry is presented. (auth)

7059

ON THE MAGNETOHYDRODYNAMICS OF CONDUCTING FLUIDS. S. I. Braginskii. Zhur. Eksptl'. i Teoret. Fiz. 37, 1417-30(1959) Nov. (In Russian)

The approximate form of magnetohydrodynamic equations was derived for a fluid possessing a small electrical conductivity (small magnetic Reynolds numbers) and located in an external magnetic field. Some characteristic problems are considered which describe the physical nature of the behavior of such fluids in a strong magnetic field. (auth)

7060
CONCENTRATION OF CHARGED PARTICLES IN PLASMA OF SPARK DISCHARGE CHANNEL. A. A. Mak (State Optic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 37, 1488-90 (1959) Nov. (In Russian)

The profile of the He II line $\lambda = 4686A$, emitted by a discharge channel, was studied in order to determine the concentration of charged particles in the channel. During the initial moments the line expands and shifts toward the red side without exhibiting any asymmetry. The absolute magnitudes of shifts (up to 8A) and the half-width of lines (up to 50A) indicate considerable concentration of charged particles. The lower limit of channel temperature for $t \approx 0.1$ μsec was 6 to 7 ev; the maximum luminosity temperature is 2 ev. Thus, reabsorption is absent at $t \lesssim 0.1$ μsec; for longer times and pressures above 8 atm. the reabsorption appears to be considerable. (R.V.J.)

7061
PLASMA PHYSICS AND THE PROBLEM OF CONTROLLED THERMONUCLEAR REACTIONS. VOLUME II. M. A. Leontovich, ed., J. Turkevich and D. Hicks, trans. eds. Translated from the Russian by A. J. Meadows, D. L. Allan, and N. Kemmer. New York, Pergamon Press, 1959. 460p.

This volume was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract Nos. 620-39.

7062
IMPROVEMENTS IN OR RELATING TO GAS DISCHARGE APPARATUS FOR PRODUCING THERMONUCLEAR REACTIONS. George Paget Thomson and Moses Blackman. (to United Kingdom Atomic Energy Authority). British Patent 817,681. Aug. 6, 1959.

A thermonuclear reactor is described. Ionized D is contained in a nonmagnetic metal toroid 4-m over-all diam. Acceleration is produced by HF generators through wave guides. The magnet and cooling jacket arrangement are described. (T.R.H.)

7063
PLASMA GENERATOR. W. H. Bostick and V. G. McIntosh (to U. S. Atomic Energy Commission). U. S. Patent 2,900,548. Aug. 18, 1959.

A small compact plasma generator is described which produces a high-density, relatively pure plasma with a minimum gas expenditure. In its preferred embodiment, the generator generally comprises a pair of occluded gas electrodes spaced by insulation and between the ends of which an arc is struck to produce a curved discharge path and the self-induced magnetic field of the discharge current deforming the resultant plasma outwardly from the ends of the electrodes.

7064
ACCELERATED PLASMA SOURCE. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,902,614. Sept. 1, 1959.

A substantially contaminant-free plasma source wherein a blob of plasma is accelerated by self-generated magnetic fields away from contaminating neutral particles at the point of origin of the plasma is described. To this end the plasma source generally includes means for generating a gaseous discharge in substantially the form of an inverted cone. By virtue of the pinch effect a strong self-induced magnetic field about the plasma of the conical discharge compresses the lower end but does not materially compress the upper end. The corresponding self-induced magnetic field strength at the cone vertex is greater than at the base and the resulting magnetic pressure gradient axially upward produces a net upward force on the plasma whereby a blob is accelerated upwardly away from the region of the discharge.

Shielding Calculations

7065 JAERI-1005
Japan. Atomic Energy Research Inst., Tokyo.
OPTICAL PROPERTIES OF THE SHIELDING WINDOWS OF Co-60 GAMMA RADIATION FACILITY. Akibumi Danno, Kakuji Yamamoto, Ichiro Yamaguchi, and Yuki Kawarazaki. 1959. 23p.

Shielding windows manufactured by Corning, Penberthy and Nippon Kogaku Co. were examined. Bubbles, stones, and scratches were found in all three windows in considerable quantity, and striae were found in the windows of Penberthy and Nippon Kogaku. Transmittances of the windows measured for D-line were about 25% for Nippon Kogaku's, 25% for Corning's, and 14% for Penberthy's. (W.D.M.)

7066 NAA-SR-Memo-4649
Atomics International Div., North American Aviation, Inc. Canoga Park, Calif.
GRACE II—AN IBM 709 PROGRAM FOR COMPUTING GAMMA-RAY ATTENUATION AND HEATING IN CYLINDRICAL AND SPHERICAL GEOMETRIES. D. S. Duncan and A. B. Speir. Nov. 12, 1959. 61p. OTS.

GRACE II is a multigroup, multiregion, gamma-ray attenuation code written in FORTRAN II for the IBM 709. The code is used to compute the total dose rate or heat generation rate from either a spherical or a cylindrical source. The source may be located in either the central region of the system or in a concentric shell region surrounding it. The source distribution may be uniform, exponential or have a polynomial variation in the radial direction, and, in the case of cylindrical geometry, may also have a polynomial variation in the axial direction. A least squares fit is used to obtain the polynomial coefficients. The buildup factor is represented analytically in a double exponential form. The shield regions outside the source volume may be either semi-infinite slabs or concentric shells. As many as 22 regions, 10 mesh points per region, 20 gamma-ray energy groups, 20 shield materials, and 20 material buildup factors may be included in a single calculation. (auth)

Theoretical Physics

7067
INTERPRETATION OF QUANTUM MECHANICS. THE CASE OF THE PRESENCE OF AN ELECTROMAGNETIC FIELD. Assène Datzeff. Compt. rend. 249, 2725-7 (1959) Dec. 21. (In French)

A new point of view on the interpretation of quantum mechanics previously presented is extended. The results are generalized for the case of the presence of an electromagnetic field. (T.R.H.)

7068
CRITICAL STUDY AND RESOLVABLE SIMPLIFIED FORM OF TOMONAGA APPROXIMATION FOR INTERMEDIATE COUPLING. J. Mandelbrojt (Ecole Normale Supérieure, Paris). Nuovo cimento (10) 14, 625-36 (1959) Nov. 1. (In French)

Tomonaga's intermediate coupling approximation is discussed critically for all values of the coupling constant. A simplified approximation which has similar properties is given and the corresponding equations are solved explicitly. (auth)

7069
SOME CONSEQUENCES FOR QUANTUM ELECTRODYNAMICS OF AN ESSENTIAL SINGULARITY AT $\alpha = 0$. P. J. Redmond (Univ. of California, Berkeley). Nuovo cimento (10) 14, 771-7(1959) Nov. 16. (In English)

Many authors have suggested that the functions of relativistic field theories are singular in the region of vanishing coupling constant. As an illustration the argument of Gell-Mann and Low concerning the behavior of quantum electrodynamics at small distances is re-examined. Within the context outlined, much weaker restrictions are found than those indicated in the original paper. If an approximation to the photon propagator is calculated by summing a selected infinite set of contributions to the spectral density function, the resulting expression has an essential singularity at $\alpha = 0$. It is not of the form predicted by Gell-Mann and Low, but it does satisfy the weaker conditions which are discussed. (auth)

7070
A SOLUBLE MODEL IN FIELD THEORY. [PART] I. E. Kazes (Pennsylvania State Univ., University Park). Nuovo cimento (10) 14, 815-26(1959) Nov. 16. (In English)

The Lee model was modified by giving the V-particle a more complicated structure, and still leaving the N-θ scattering amplitude exactly soluble. This modification also yields a wider variety of soluble processes. The same limitation that applies to the cut-off size in the Lee model is reproduced in this model. Mass and wave function renormalization can be performed exactly and vertex renormalization is not required. The calculation is performed by using the Hamiltonian formalism as well as dispersion methods. (auth)

7071
STATISTICAL THEORY OF THE NUCLEON GAS ARBITRARY TEMPERATURES. P. Gombás and D. Kisdi (Technical Univ., Budapest and Hungarian Academy of Sciences, Budapest). Z. Physik 156, 125-30(1959). (In German)

The statistical theory of a nucleon gas was developed for arbitrary temperatures, and the basic equation system of the problem was derived. For the interaction of the nucleons a linear combination of Wigner, Majorana, Heisenberg, and Bartlett forces was established. (tr-auth)

7072
IMPEDANCE AND LAGRANGE FUNCTIONS OF LINEAR DISSIPATIVE SYSTEMS. J. Meixner (Technische Hochschule, Aachen). Z. Physik 156, 200-10(1959). (In German)

A simple proof is given for the theorem that the difference of electrical and magnetic energies is the same for equivalent 2n-terminal networks, to which the same electromotive forces are applied. For this difference, called the Lagrange function, an explicit expression in terms of the admittance matrix, is given. An analogous theorem is proved in the thermodynamic theory of relaxation phenomena, and an extension is given to the case of general linear dissipative systems. (auth)

7073
THE LORENTZ INVARIANCE FORMULATION OF THE CANONICAL MOTION EQUATIONS IN PARTICLE MECHANICS. Fritz Sauter (Universität, Cologne). Z. Physik 156, 275-86(1959). (In German)

By means of the hamiltonian variational principle it is shown that the canonical equations of the hamiltonian particle mechanics can be written in Lorentz covariant form. The Hamilton-Jacobs differential equation is given in invariant form and its equivalence with the canonical equations is indicated. (tr-auth)

7074
BOUND PAIRS IN FERMI LIQUIDS. W. Brenig (Max-Planck-Institut für Physik and Astrophysik, Munich). Z. Physik 156, 525-33(1959). (In German)

The effect of a hard core on the energy of bound pair states in Fermi liquids is considered. It turns out that such bound pairs can exist in nuclear matter for the real nuclear forces, but not in the (non-superfluid) He^3. The importance of this fact for a possible understanding of the superfluidity is discussed briefly. (auth)

7075
QUANTUM STATISTICS OF A GAS WITH DIFFERENT ORBITAL AND SPIN TEMPERATURES. E. Fick (Technische Hochschule, Munich). Z. Physik 157, 407-32 (1960). (In German)

A system of particles with spin in a magnetic field may possess an orbital temperature T_θ different from the spin temperature $T_s (\gtrless 0)$, if it is possible to neglect the energetic interaction between the orbital and the spin system. The calculation of the most probable quantum statistical distribution of identical independent particles on the orbital and spin energy levels yields the introduction of three Lagrange multipliers—according to the fact that the orbital and the spin energy and the number of particles are fixed—representing the orbital and spin temperature and a generalized Planck's "characteristic function." Apart from the Boltzmann approximation being valid in the case of small spin values for $T_\theta \gg T_e$ (T_e = customary degeneration temperature) and arbitrary $T_s \gtrless 0$, the distributions and the orbital and the spin energy depend on both the temperatures T_θ and T_s coming from the principle of exclusion for Fermi or Bose particles. The equations of state are discussed. There are four heat capacities, which possess characteristic peaks. Instead of the well-known temperature independence of the paramagnetism of degenerated conducting electrons, one obtains $\chi \sim T_\theta/T_s$. The behavior of the Einstein condensation of a Bose gas is considered. (auth)

7076
GROUP THEORETICAL INVESTIGATION OF THE SHELL MODEL. I. THE MATHEMATICAL THEORY OF THE HAMILTON OPERATOR. Martin Kretzschmar (Universität, Göttingen, Ger.). Z. Physik 157, 433-56(1960). (In German)

The harmonic oscillator shell model with LS coupling is studied from a group-theoretical point of view. Leaving aside for the moment the spin and isospin degrees of freedom, the most general transformation group, which leaves the hamiltonian invariant, is determined to be the unitary group in 3A dimensions (U_{3A}), where A is the nucleon number. The following chain of subgroups is considered: $U_{3A} > U_3 \times U_A > D_3^{(+)} \times U_A > D_3^{(+)} \times G_A$. ($U_3$ or U_A unitary group in 3 or A dimensions, $\times$ means direct product, $D_3^{(+)}$ rotation group in 3 dimensions, G_A group of all permutations of the A nucleons). The classification of the wavefunctions with respect to energy is equivalent to a clas-

sification according to irreducible representations of U_{3A}. Therefore one can classify the wave functions in each energy level with respect to irreducible representations of U_3, $D_3^{(+)}$ and G_A by studying the laws of decomposition of the irreducible representations of U_{3A} into those of the subgroups. Such a classification is of physical importance in connection with the Elliot model. The last step going from $D_3^{(+)} \times U_A$ to $D_3^{(+)} \times G_A$ leads in a natural way to the problem of center-of-mass motion and one obtains a clear separation of the totality of wave functions into "good" states and "spurious" states. The most appropriate mathematical tool to deal with this question is the theory of "inner plethysm." (auth)

7077

APPLICATION OF THE DISPERSION RELATIONS METHOD IN QUANTUM ELECTRODYNAMICS. V. Ya. Fainberg. Zhur. Eksptl'. i Teoret. Fiz. 37, 1361-71 (1959) Nov. (In Russian)

An approximate set of dispersion equations for Green's function of the photon and vertex part was derived in quantum electrodynamics on the basis of the dispersion relations and unitarity conditions. The "nonsubtraction" procedure is employed in an asymptotic investigation of the solutions of the equation. Agreement with the renormalized perturbation theory when the fine structure constant tends to zero is accepted as the boundary condition. It is shown that the vertex function asymptotically decreases with growth of the square of the photon 4-momentum $q^2 = (p_+ + p_-)^2$ for $p_+^2 = p_-^2 < m^2$ where p_-, p_+ are the electron and positron 4-momenta. This leads to finite renormalization of the charge in the approximation under consideration. (auth)

REACTOR TECHNOLOGY

General and Miscellaneous

7078 AERE-R-2947

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ORGANIZATION AT A.E.R.E. HARWELL FOR SAFETY CLEARANCE OF REACTORS. N. G. Stewart and L. Wilson. Oct. 1959. 15p. BIS.

The methods developed and used by the U.K.A.E.A. Research Group Reactor Safety Clearance Committee on the design features and operational procedures necessary to ensure safety from nuclear hazards arising in connection with reactors are summarized. The conclusions to be drawn are pointed out. The need is stressed for preparation of a comprehensive safety document for each reactor or approach-to-criticality installation and for detailed scrutiny of it by independent experts. (auth)

7079 CRRP-873

Atomic Energy of Canada Ltd., Chalk River, Ont.

A COMPUTER PROGRAM FOR REACTOR STUDIES. M. F. Duret and R. Marriott. Oct. 1959. 198p. (AECL-911). AECL.

To find the optimum value for each of the many parameters occurring in the design of a nuclear power station, a great deal of computation has to be done. To reduce this load of routine calculations a computer program was written in 1957 and was described in RPI-27. While the program turned out to be very useful, it was soon recognized that it was also extremely inflexible. The effect of changes in some design parameters could be studied only by changing the program as well as the input data. This practice was very time-consuming. While it is not practicable to write a computer program for the Datatron which is sufficiently general at the outset to take care of all conceivable reactor optimization problems, it is possible to break the program up into a number of self-contained sections common to many problems. These sections can then be used to compose larger programs suitable for a variety of problems. A number of these sections are described and how their use in building up a "reactor optimization program" is discussed. (auth)

7080 IDO-16551

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MISCELLANEOUS TESTS WITH THE SPERT I REACTOR. G. O. Bright and S. G. Forbes. Oct. 23, 1959. 17p. Contract AT(10-1)-205. OTS.

Presented at American Nuclear Society Meeting, June 1957.

Several experiments were performed in the Spert I reactor which have not been reported elsewhere. These include the determination of the power coefficient of reactivity in the boiling reactor, the effect of changes in moderator properties, starting power, and static water head over the core on power excursion behavior; and the performance of a transient power excursion with a 5 msec period. Results of these tests are presented in descriptive and graphic form. (auth)

7081 KAPL-1954

Knolls Atomic Power Lab., Schenectady, N. Y.

CRITICAL FLOW VELOCITIES FOR COLLAPSE OF REACTOR PARALLEL-PLATE FUEL ASSEMBLIES. Daniel R. Miller. Aug. 26, 1958. 31p. Contract W-31-109-Eng-52. OTS.

Theoretical formulas are presented for prediction of the flow velocity at which collapse occurs in long parallel-plate assemblies. Beyond the critical velocity the pressure-unbalance forces developed as a consequence of a small deflection exceed the corresponding elastic restraining forces, and the plates collapse. Both flat- and curved-plate assemblies are considered, and the applicability of the formulas to design of reactor fuel-plate assemblies is discussed. (auth)

7082 KAPL-M-WBW-8

Knolls Atomic Power Lab., Schenectady, N. Y.

ACTIVATION EXPERIMENTS IN AN NCR-TYPE LATTICE. W. B. Wright, S. F. Weinstein, and A. D. Musto. Dec. 9, 1959. 25p. Contract W-31-109-Eng-52. OTS.

In an effort to evaluate the accuracy of the production codes in the areas of explicit representation of control rods and discrete burnable poison and the calculation of power peaking, a series of activation experiments were performed in the PPA within an NCR-type lattice. Single and multiple gaps, burnable poison slabs, cadmium slabs, and eventually grotesque combinations of gaps and slabs were studied. The expected activity was calculated with WANDA using MS input. (W.D.M.)

7083 KAPL-M-WJL-5

Knolls Atomic Power Lab., Schenectady, N. Y.

A SIMPLIFIED TECHNIQUE FOR CALCULATING SPECTRUM-DEPENDENT WATER-GAP PEAKING. W. J. Levedahl. Dec. 22, 1959. 15p. Contract W-31-109-Eng-52. OTS.

It has been shown that the experimental power peaking near water gaps or water reflectors exceeds the peaking calculated by diffusion codes. A simple method is described by which the peaking from diffusion theory code

calculations can be corrected using only numbers printed in the code output. (W.D.M.)

7084 MIT-5001

Massachusetts Inst. of Tech., Cambridge. Nuclear Engineering Project.

CHEMICAL PROBLEMS OF NON-AQUEOUS FLUID-FUEL REACTORS. George Scatchard, Herbert M. Clark, Sidney Golden, Alvin Boltax, and Reinhardt Schuhmann, Jr. Oct. 15, 1952. Decl. Oct. 7, 1959. 99p. Contract AT(30-1)-1359. OTS.

The three main chemical problems of non-aqueous fluid-fuel reactors are selection of a fuel system which meets nuclear and thermal requirements, control of corrosion of structural materials, and development of an efficient and economical separation process. The problems of the fast-neutron reactor with a core of fused NaCl, $PbCl_2$, UCl_4 mixture and a blanket of fused UCl_4 are discussed, except for the separation process. Brief treatment is given the Bi–U–Pu fuel system for thermal reactors, including tentative flowsheets for the separation process. A detailed discussion of the experiments of Bareis at Brookhaven and related experiments on the distribution of various metals between liquid Bi and fused-salt solutions is given, the experimental results correlated, and application made to reactor problems. A general discussion is given of non-aqueous high-temperature separation processes. (L.M.T.)

7085 NAA-SR-Memo-1807

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HETEROGENEOUS SYSTEMS AND MINIMUM CRITICAL MASS. Anthony V. Campise. Dec. 17, 1956. 27p. OTS.

Slightly enriched, thermal systems moderated and reflected by a hydrocarbon, were studied to gain an insight into the characteristic problems involved in constructing a heterogeneous lattice that would exhibit minimum variations in the thermal flux. The purpose of restricting the thermal flux to small variations is to acquire a uniform power density per fuel element. (W.D.M.)

7086 NAA-SR-Memo-2033

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

LATTICE CALCULATIONS USING THE IBM-704 WANDA-2-DIFFUSION CODE. W. O. Allen, K. E. Buttrey, and R. O. Williams, Jr. Aug. 1, 1957. 8p. OTS.

A test calculation of thermal utilization was made to demonstrate the feasibility of using the IBM WANDA-2 diffusion code for lattice calculations. The technique used is to force the fast neutron flux to be uniform throughout the cell and thus make the slowing down density a function only of the fast group removal cross section. It is felt that the code will be useful for calculations involving complex geometries. (J.R.D.)

7087 NAA-SR-Memo-3872

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

FLUX DISTRIBUTION MEASUREMENTS IN OMR CORES. V. A. Swanson. May 14, 1959. 14p. OTS.

The neutron flux distributions in a flexible mockup of an OMR core portion were measured. Two lattice configurations were studied. The diffusion length of thermal neutrons in the moderator and the critical sizes of the lattices were also measured. Results, together with some comparisons with theoretical calculations, are tabulated. (J.R.D.)

7088 NAA-SR-Memo-4493

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

VAPOR–LIQUID EQUILIBRIUM COMPOSITIONS FOR TERPHENYLS AND HIGH BOILERS. R. W. Burkhardt and W. N. Bley. Oct. 23, 1959. 16p. OTS.

Results of an investigation to obtain vapor-liquid equilibrium information upon which to base design of a stripping column to reclaim useful terphenyl are discussed. A description of the experimental equipment and technique is given, and sample calculations are included. (J.R.D.)

7089 NP-8250

Argentina. Comisión Nacional de Energía Atomica, Buenos Aires.

MEDICIÓN DEL LAPLACIANO DE UN RETICULADO DE U–H_2O CON TUBOS CONTENIENDO POLVO DE U_3O_8 ENRIQUECIDO Al 20%. INFORME No. 18. (Measurement of the Laplacian of a U–H_2O Lattice with Tubes Containing 20% Enriched U_3O_8 Powder. Report No. 18). D. Bovisio de Ricabarra, R. Faradjie de Turjanski, and J. U. Koppel. 1959. 18p.

Within the framework of preliminary studies for a reactor with water as moderator and U_3O_8 as fuel, a series of measurements were made on lattice of different characteristics. The results obtained for the first of these lattices are given, and the techniques and methods used are described and justified. (tr-auth)

7090 WAPD-TM-156

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

ART—A PROGRAM FOR THE TREATMENT OF REACTOR THERMAL TRANSIENTS ON THE IBM-704. J. E. Meyer, R. B. Smith, H. G. Gelbard, D. E. George, and W. D. Peterson. Nov. 1959. 85p. Contract AT-11-1-GEN-14. OTS.

A description is given of a program by which the behavior of a nuclear reactor during various thermal transients may be studied. The program is written for a 32,000-word IBM-704 computer with six tape units. It is designed to predict the behavior of a water-cooled and moderated reactor with flat plate fuel elements during transients which are slower than a prompt excursion and during which the reactor flow, inlet temperature, and control rod motion may be specified as a function of time. (auth)

7091

NUMERICAL METHODS FOR NUCLEAR REACTOR CALCULATIONS. Gurii Ivanovich Marchuk. Suppl. Nos. 3-4 of Atomnaya Energ. New York, Consultants Bureau, Inc., 1959. 298p. $60.00.

An attempt is made at a systematic exposition of numerical methods for thermal, intermediate, and fast reactor calculations. Particular attention is devoted to the problems of critical mass, space-energy flux distribution, and neutron importance. Effective methods are given for reducing the basic and adjoint reactor equations to a set of multi-group diffusion equations. These equations are then solved by the method of difference factorization. Homogenization methods for heterogeneous reactor calculations are considered. Only problems of a mathematical nature are treated. The book is intended for graduate students in physics and engineering specializing in reactor calculations. (W.D.M.)

7092

EFFECT OF TEMPERATURE ON REACTOR DYNAMICS. G. Kourim. Atomwirtschaft 4, 533-6(1959) Dec. (In German)

The reactor temperature influences the chain reaction mainly through density changes resulting from thermal expansion and through changes in the relative velocities of neutrons and atomic nuclei. This becomes evident in the differing course of the temperature dependence of the fission and capture cross-sections of the various reactors

and fuel materials. The almost always non-linear relation between temperature and reactivity is described for a few completed installations. The variation with time of the temperature and the influence of temperature on reactor performance are investigated with the aid of a thermal flow diagram for which an electrical circuit diagram was substituted in order to simplify the equations. (auth)

7093

THERMAL CALCULATION OF THE OPERATING CHANNEL OF A NUCLEAR REACTOR. I. S. Kochenov. Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 64-7(1959) Dec. (In Russian)

The effect is considered of coefficients of irregularity of heat liberation with height (taking into account local jumps in the temperature field) on the thermal operating conditions of a channel in a reactor. (auth)

7094

RADIATION PROTECTION IN REACTORS AND NUCLEAR INSTALLATIONS. [PART IV]. M. Oberhofer and P. Kienle (Technische Hochschule, Munich). Kerntechnek 1, 150-6(1959) Nov. (In German)

The bases of radiation protection measurement techniques are considered. The principles of radiation detection for charged and uncharged particles and for quantum radiations are illustrated. The operation of ionization chambers and their application to the measurement of integral doses and dose rates are described. (tr-auth)

7095

REACTOR PERTURBATION THEORY OF HIGHER ORDER AND THE ACCURACY RANGE OF THE PERTURBATION THEORY OF THE FIRST ORDER IN THE TREATMENT OF CAVITIES. H. Dušek and W. Oldekop (Siemens-Schuckertwerke A. G., Erlangen, Ger.). Nukleonik 1, 342-6(1959) Dec. (In German)

The perturbation theory of the first order previously described (Nukleonik 1, 265(1959)), which is derived from the multigroup collision equation and by a consequent carrying out of the P_1 approximation permitted the treatment of cavities, is expanded to a perturbation theory of higher order. The peculiarities occurring in cavities in higher order are discussed. The accuracy range of the perturbation theory of the first order was estimated with the theory of the second order on two examples. (tr-auth)

7096

TIME-DEPENDENT NEUTRON FLUXES ACCORDING TO MULTIGROUP DIFFUSION THEORY. Ahmed Yuksel Özemre (Inst. for Theoretical Physics, Istanbul). Nukleonik 1, 347-50(1959) Dec. (In English)

This paper deals with the distribution of time-dependent neutron fluxes in a given multiplying medium according to multigroup diffusion theory. The first part of the paper is devoted to a brief review of the well-known study of non-stationary monoenergetic neutron diffusion. The second part is concerned with the multigroup theory of the non-stationary case. It is found that one has to associate to each root of the critical equation a number of quantities equal to the number of energetic groups, which is called, in analogy with the section A, generalized geometrical bucklings. In the appendix the problem of reality of the roots of the critical equation is qualitatively discussed. (auth)

7097

THE RESPONSE OF A NUCLEAR POWER REACTOR TO A LINEAR REACTIVITY VARIATION. Henri B. Smets (Centre d'Etude de l'Energie Nucléaire, Mol, Belg.). Nukleonik 1, 351-7(1959) Dec. (In English)

The response of a nuclear reactor to a linear reactivity variation is studied by topological methods in the case of non-negligible temperature reactivity dependence for adiabatic, constant power removal and Newton's law of cooling reactor models. The stabilizing effect of the delayed neutrons and the properties of the solutions in case of fast accidents are considered in detail. Comparison of theoretical approximate results with numerical solutions and experimental results obtained on the SPERT I Reactor and the KEWB Reactor is very satisfactory. (auth)

7098

REACTOR CONTROL. John Jerome Goett. British Patent 817,755. Aug. 6, 1959.

A reactor safety control device is described. It consists of a rotating flywheel which has neutron-absorbing balls arranged in buckets around the perimeter. When an unsafe condition in the reactor demands immediate shutdown, electrically operated gates on the buckets are opened allowing the balls to be centrifugally injected into channels in the reactor core. (T.R.H.)

7099

CONTROL DEVICE FOR A NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). British Patent 817,756. Aug. 6, 1959.

A reactor control rod and its manufacture are described. The rod is made up of concentric layers of a low danger-coefficient material with a neutron-absorber layer between. It can be prepared by wrapping Cd foil on a thin Al tube, placing inside another Al tube and drawing. Details of the drawing operation and equipment are given. A control-rod drive and position-indicating device are also described. (T.R.H.)

7100

IMPROVED CONSTRUCTION OF THE COVER OF A HETEROGENEOUS NUCLEAR REACTOR. (to Allmänna Svenska Elektriska Aktiebolaget). British Patent 818,667. Aug. 19, 1959.

An improved cover for a previously described reactor is presented. The cover includes a collector vessel for coolant for heat removal. This vessel is attached to the under side of the cover by bushings inserted in inlet holes for fuel elements in the main cover. (T.R.H.)

7101

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Geoffrey Herbert Haines and Peter John Grant. (to General Electric Co., Ltd.). British Patent 818,779. Aug. 26, 1959.

A core cover plate for reactors is described which protects the pressure vessel from heat and radiation. This protective shield is formed of layers of mild steel and neutron absorbers. It has openings for fuel element and control rod passage. The cover is cooled by gas flowing in the space defined by it within the pressure vessel. (T.R.H.)

7102

HIGH TEMPERATURE REACTOR FUEL ELEMENT. (to North American Aviation, Inc.). British Patent 822,180. Oct. 21, 1959.

A reactor fuel element design which operates at surface temperatures of 800°F is presented. It consists of 1.3%-enriched U in Al plates arranged in Al supports to form a long box. This assembly rests in a Zr box with a creep stop arrangement. (T.R.H.)

7103
IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Claude Dixon Gibb (to C. A. Parsons and Co., Ltd.). British Patent 826,228. Dec. 31, 1959.

A fuel element design is described which allows for linking together of axially aligned fuel elements for simultaneous charge or discharge. (T.R.H.)

7104
CONDUCTING HYDROCARBON CONVERSIONS IN NUCLEAR REACTORS AND APPARATUS THEREFOR. (to Esso Research and Engineering Co.). British Patent 826,583. Jan. 13, 1960.

An apparatus is described which obtains in a reactor a high-intensity gamma flux with reduced slow and thermal neutrons. Parallel Cd plates are arranged in the reactor to absorb the neutrons and emit gamma radiation. The plates are of such a thickness and are so spaced that the gamma irradiation of material passing through this zone is accomplished efficiently. (T.R.H.)

7105
METHOD OF PREPARING A FUEL ELEMENT. R. A. Noland and C. C. Stone (to U. S. Atomic Energy Commission). U. S. Patent 2,902,590. Sept. 1, 1959.

A method is presented for joining sections of uranium rod which are clad in a corrosion-resistant material of higher melting point than uranium. The method includes the steps of preferentially etching the uranium in the ends of the sections to be joined to depress the level of the uranium slightly below that of the cladding, bringing the ends to be joined together, applying axial pressure to the joint, and heli-arc welding the joint while rotating the joint to fuse the cladding to a uniform depth of about 50% of the thickness of the cladding.

7106
SHEATHED TUBE AND APPARATUS AND METHOD OF PRODUCTION THEREOF. L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,900,315. Aug. 18, 1959.

A tubular fuel element covered inside and out by a unitary covering tube originally about twice its length and of small enough diameter to fit snugly inside the fuel tube is described. The covering tube is then reentrantly folded back by a pressure-die mechanism over both ends of the fuel tube and against its outside until the folded back ends of the covering tube meet where they are welded in a single seam running circumferentially around the middle of the resulting assembly.

7107
FUEL ROD ASSEMBLY. E. Hutter (to U. S. Atomic Energy Commission). U. S. Patent 2,902,422. Sept. 1, 1959.

A cluster of nuclear fuel rods and a tubular casing through which a coolant flows in heat-exchange contact with the fuel rods are described. The casing is of trefoil section and carries three fuel rods, each of which has two longitudinal fins that engage the casing and a third serrated fin engaging the serrated fins of the other two fuel rods, whereby the fuel rods are held in the casing and are interlocked against relative longitudinal movement.

7108
A NEUTRONIC REACTOR. E. A. Luebke and L. B. Vandenberg (to U. S. Atomic Energy Commission). U. S. Patent 2,902,423. Sept. 1, 1959.

A nuclear reactor for producing thermoelectric power is described. The reactor core comprises a series of thermoelectric assemblies, each assembly including fissionable fuel as an active element to form a hot junction and a thermocouple. The assemblies are disposed parallel to each other to form spaces and means are included for introducing an electrically conductive coolant between the assemblies to form cold junctions of the thermocouples. An electromotive force is developed across the entire series of the thermoelectric assemblies due to fission heat generated in the fuel causing a current to flow perpendicular to the flow of coolant and is distributed to a load outside of the reactor by means of bus bars electrically connected to the outermost thermoelectric assembly.

7109
HOMOGENEOUS NUCLEAR POWER REACTOR. L. D. Percival King (to U. S. Atomic Energy Commission). U. S. Patent 2,902,424. Sept. 1, 1959.

A homogeneous nuclear power reactor utilizing forced circulation of the liquid fuel is described. The reactor does not require fuel handling outside of the reactor vessel during any normal operation including complete shutdown to room temperature, the reactor being self-regulating under extreme operating conditions and controlled by the thermal expansion of the liquid fuel. The liquid fuel utilized is a uranium, phosphoric acid, and water solution which requires no gas exhaust system or independent gas recombining system, thereby eliminating the handling of radiolytic gas.

7110
METHOD OF PREPARING A FUEL ELEMENT FOR A NUCLEAR REACTOR. J. H. Handwerk and R. A. Bach (to U. S. Atomic Energy Commission). U. S. Patent 2,900,263. Aug. 18, 1959.

A method is described for preparing a reactor fuel element by forming a mixture of thorium dioxide and an oxide of uranium, the uranium being present in an oxidation state at least as high as it is in U_3O_8, into a desired shape and firing in air at a temperature sufficiently high to reduce the higher uranium oxide to uranium dioxide.

7111
POSITIONING DEVICE. R. R. Wall and D. L. Peterson (to U. S. Atomic Energy Commission). U. S. Patent 2,904,168. Sept. 15, 1959.

A positioner is described for a vertical reactor-control rod. The positioner comprises four grooved friction rotatable members that engage the control rod on all sides and shift it longitudinally. The four friction members are drivingly interconnected for conjoint rotation and comprise two pairs of coaxial members. The members of each pair are urged toward one another by hydraulic or pneumatic pressure and thus grip the control rod so as to hold it in any position or adjust it. Release of the hydraulic or pneumatic pressure permits springs between the friction members of each pair to force them apart, whereby the control rod moves quickly by gravity into the reactor.

7112
CONTROL DEVICE. J. J. Dickson (to U. S. Atomic Energy Commission). U. S. Patent 2,904,487. Sept. 15, 1959.

A bimetallic helix is described comprising a neutron-flux-responsive strip and a second strip having the same coefficient of thermal expansion for adjusting the extent to which an inner neutron-absorbing member protrudes from an outer hollow neutron-absorbing member.

7113
NUCLEAR REACTOR FUEL SYSTEMS. B. J. Thamer, R. M. Bidwell, and R. P. Hammond (to U. S. Atomic

Energy Commission). U. S. Patent 2,904,488. Sept. 15, 1959.

Homogeneous reactor fuel solutions are reported which provide automatic recombination of radiolytic gases and exhibit large thermal expansion characteristics, thereby providing stability at high temperatures and enabling reactor operation without the necessity of apparatus to recombine gases formed by the radiolytic dissociation of water in the fuel and without the necessity of liquid fuel handling outside the reactor vessel except for recovery processes. The fuels consist of phosphoric acid and water solutions of enriched uranium, wherein the uranium is in either the hexavalent or tetravalent state.

7114

INDEXING MECHANISM. L. J. Kock (to U. S. Atomic Energy Commission). U. S. Patent 2,905,338. Sept. 22, 1959.

A device is presented for loading and unloading fuel elements containing material fissionable by neutrons of thermal energy. The device comprises a combination of mechanical features including a base, a lever pivotally attached to the base, an indexing plate on the base parallel to the plane of lever rotation and having a plurality of apertures, the apertures being disposed in rows, each aperture having a keyway, an index pin movably disposed on the lever normal to the plane rotation, a key on the pin, a sleeve on the lever spaced from and parallel to the index pin, a pair of pulleys and a cable disposed between them, an open collar rotatably attached to the sleeve and linked to one of the pulleys, a pin extending from the collar, and a bearing movably mounted in the sleeve and having at least two longitudinal grooves in the outside surface.

7115

FUEL ELEMENT FOR A NEUTRONIC REACTOR. L. Tonks (to U. S. Atomic Energy Commission). U. S. Patent 2,905,611. Sept. 22, 1959.

A fuel element is presented for a reactor comprising a stack of conical bodies of nonfissionable material disposed with the vertex up carrying wafers of fissionable material in grooves near the periphery. These bodies are in a jacket which contains a thermally conducting liquid immersing the bodies. Gaseous fission products pass upwardly through central apertures in the bodies while fragments of fissionable material are trapped by vertical projections or walls on the upper surface of the bodies.

7116

CENTRAL CONTROL SYSTEM. L. B. Borst (to U. S. Atomic Energy Commission). U. S. Patent 2,905,612. Sept. 22, 1959.

A control element is presented for neutronic reactors. The element is longitudinally expansible and compressible and remains within the reactor core at all times. The effectiveness of the element as to neutron absorption is varied by longitudinally compressing or expanding the element, the effectiveness being greatest when the element is fully expanded and least when it is fully compressed. Two embodiments of the invention are described, one being a coiled spring and the other being an element formed from a plurality of interconnected links.

7117

REACTOR COOLING. C. F. Quackenbush (to U. S. Atomic Energy Commission). U. S. Patent 2,906,683. Sept. 29, 1959.

A nuclear reactor with provisions for selectively cooling the fuel elements is described. The reactor has a plurality of tubes extending throughout. Cylindrical fuel elements are disposed within the tubes and the coolant flows through the tubes and around the fuel elements. The fuel elements within the central portion of the reactor are provided with roughened surfaces of material. The fuel elements in the end portions of the tubes within the reactor are provided with low conduction jackets and the fuel elements in the region between the central portion and the end portions are provided with smooth surfaces of high heat conduction material.

Power Reactors

7118 AECL-952

Atomic Energy of Canada Ltd., Chalk River, Ont.; Ontario. Hydro-Electric Power Commission, Toronto; and Canadian General Electric Co., Ltd., Toronto.

NPD-2 DESIGN DESCRIPTION—CANADA'S FIRST NUCLEAR POWER STATION. [1959?]. 27p.

A detailed design description of the NPD-2 station is presented. The station employs several advanced design concepts and is characterized by a reactor which uses natural uranium oxide as fuel, D_2O near atmospheric pressure as the moderator, and pressurized D_2O as the coolant. A series of pressure tubes passing through the reactor is used to contain the coolant. Power-output control and emergency shut-down control of the reactor are both accomplished entirely through control of the moderator level and to a limited extent of its temperature. (W.D.M.)

7119 AECU-4601

Duquesne Light Co., Shippingport, Penna.

MONTHLY OPERATING REPORT [FOR] NOVEMBER 1959. 38p. Contract AT(11-1)-292. OTS.

The Station remained shutdown. The Core Removal Cooling System was in operation. All the boilers and main steam leads were layed-up and the 1A, 1B, and 1C reactor coolant pumps were rotated twice during the month. The 1B boiler was leak tested prior to lay-up. All reference water specifications were maintained in plant auxiliary systems. Data are included on fission product activities at the inlet and outlet to the AC and BD purification demineralizers. All boiler secondaries were layed up dry with a one to five psig nitrogen blanket. Refueling operations began November 2, 1959, and proceeded according to schedule. The reactor pit was drained and the reactor dome removed. A water seal ring was installed sealing the reactor pit from the reactor chamber and checked for leakage. Most of the fuel ports and approximately half of the control rod mechanisms ports were cut open. Radiation Control was closely maintained in the refueling canal and all refueling personnel were carefully checked for radiation dosages. Maintenance items involved repairs to the River Water Booster Pump and the No. 2 Sump Pump and a leak test of the 1B Heat Exchanger. Addition of a fourth channel with modifications to the instrumentation system is in progress. The test program is reviewed. (D.E.B.)

7120 AECU-4603

Duquesne Light Co., Shippingport, Penna.

DETERMINATION OF FLUX LEVELS IN NEUTRON DETECTOR WELLS. SECTION II. FIRST PERFORMANCE. CORE I, SEED I. Test Results DL-S-242 (T-641313). First issue, Nov. 30, 1959. 7p. OTS.

The measured activity of an irradiated brass bolt in a BF_3 counter well was found to be due entirely to the radioactive decay of Zn-65. The thermal neutron flux in the well, calculated from the Zn-65 decay, was 2.5×10^9 neutrons per cm^2 sec. (C.J.G.)

7121 AERE-ED/R-2486

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

FREE RUNNING TURBO-CIRCULATORS FOR GAS COOLED REACTORS. P. Fortescue. Sept. 9, 1956. Decl. Sept. 1957. 13p. BIS.

Previously issued as HTGC-Memo-13.

Applications of gas turbine techniques to the production of power from gas-cooled reactors are considered. A scheme is presented in which a primary gas coolant circuit is used. Circulation is accomplished by a totally enclosed and self-operating compressor-turbine system having no external shaft and therefore no seal problem. Heat is rejected through a heat exchanger to a secondary system which could be either an open or closed circuit gas turbine or a steam cycle, depending on the temperature range contemplated. (J.R.D.)

7122 ANL-4971

Argonne National Lab., Lemont, Ill.

TECHNICAL REVIEW OF ZPR-I ACCIDENTIAL TRANSIENT—THE POWER EXCURSION, EXPOSURES, AND CLINICAL DATA. R. O. Brittan, R. J. Hasterlik, L. D. Marinelli, and F. W. Thalgott. Jan. 26, 1953. Decl. Mar. 28, 1957. 132p. Contract W-31-109-eng-38. OTS.

On June 2, 1952, a large reactivity change was made manually in a ZPR-1 assembly causing a power excursion of about one kwh, which resulted in damage to the reactor core components and radiation exposure of some of the operating personnel to perhaps several hundred rep. A description is presented of the incident, estimates are made of the exposures, and early clinical data are summarized. (C.H.)

7123 APAE-42(Vols.I and II)

Alco Products, Inc., Schenectady, N. Y.

DESIGN ANALYSIS OF A PREPACKAGED NUCLEAR POWER PLANT (1000 eKW). VOLUME I. PRIMARY AND SECONDARY SYSTEM DESIGN. VOLUME II. REACTOR DESIGN ANALYSIS. Feb. 1, 1959. (Vol. I, 218p, and Vol. II, 319p.). Contract DA-44-009-Eng-3638. OTS.

Reactor and primary and secondary system design analyses of a prepackaged nuclear power plant are presented. The plant is of the pressurized water steam-electric generating type which is air transportable skid mounted and suitable for a remote site installation. The plant design incorporates the maximum degree of reliability and simplicity and the minimum degree of maintenance and cost. The plant is capable of producing a gross electrical output of 1000 kw(e) and 5×10^6 Btu/hr for space heating. The primary system generates a total of 6.5 Mw of heat in order to supply the required electrical and heating load. (W.D.M.)

7124 APAE-54

Alco Products, Inc., Schenectady, N. Y.

SM-2 CRITICAL EXPERIMENTS—CE-1. J. W. Noaks, W. J. McCool, R. A. Robinson, E. W. Schrader, and S. H. Weiss. Nov. 30, 1959. 180p. Contract AT(30-3)-326. OTS.

Critical experiment studies were performed, varying the parameters U^{235}, B^{10}, and metal to water ratio, in the SM-2 7×7 core configuration with 38 stationary elements and seven control rods of the SM-1 (APPR-1) type. An experimental mock-up of the SM-1 was assembled using the basic SM-2 fuel plates. Excellent agreement between the SM-1 boron loading, determined by chemical analysis, and the SM-1 mock-up boron loading, for equivalent bank positions, was noted. Several SM-2 mock-ups, cold clean and midlife, were assembled and studied with regard to reflector effects, flow divider effects, relative control rod array worths, critical rod configurations, and relative power distributions. The results of these experiments indicate as satisfactory a U^{235} loading of 36.4 kg and a B^{10} loading of 63.4 grams for the SM-2. Attention is drawn to numerous power peaks present in the active core. The open seven control rod array has a slight reactivity advantage over the closed seven array and consequent minor disadvantage with respect to "stuck rod" criteria. (auth)

7125 CF-60-1-20

Oak Ridge National Lab., Tenn.

PROPOSED MODIFICATIONS TO HRE-2 CORE. C. G. Lawson. Jan. 12, 1960. 14p. OTS.

As a result of flow tests of a full-scale HRT flow model, it is proposed to modify the core flow of the HRE-2 by removing 5 or more screens, plugging the hole and reversing the direction of flow. This will provide better cooling, and mechanical scrubbing of the core wall. Calculations were made to estimate the maximum core wall temperature as related to reactor power and temperature level. The reactor should be operated with the D_2O blanket held at a temperature no higher than the core inlet temperature. A procedure for flushing solids out of the core was developed. (auth)

7126 CRRP-880

Atomic Energy of Canada Ltd., Chalk River, Ont.

SOME "FLUX PEAKING" EXPERIMENTS IN CLUSTER TYPE FUEL RODS. L. P. Robertson and R. E. Green. Nov. 1959. 48p. (AECL-925). AECL.

A group of experiments is described which was carried out to determine the flux rise in fuel bundles caused by spacers of scattering material placed between lengths of fuel. Measurements were made of the thermal flux distributions in clusters containing three types of fuel in cylindrical element 2.39 cm diameter UO_2, 1.32 cm diameter UO_2, and 1.31 cm U metal. Some of the clusters were similar to the proposed fuel charges of NPD-2. (W.D.M.)

7127 NAA-SR-4526

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

OMRE COOLANT PURIFICATION. G. O. Haroldsen. Jan. 15, 1960. 40p. Contract AT-11-1-GEN-8. OTS.

The operation of a small batch vacuum distillation system built as an integral part of the Organic Moderated Reactor Experiment (OMRE) demonstrated satisfactory separation of high boiling decomposition products from the organic coolant. Information gained in the operation of the batch system and data obtained in the related development program were used to design a continuous flash distillation system which is described. (auth)

7128 NAA-SR-Memo-2526

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PRELIMINARY ESTIMATES OF RADIOACTIVITY IN PROCESS WASTES FROM SENN 150 EMW ORGANIC REACTOR. A. R. Piccot. Mar. 3, 1958. 10p. OTS.

Proposed methods of hold-up, dilution, and discharge of routine organic wastes to the atmosphere and rivers are discussed. The evaluation is centered around problems related to the routine process wastes produced or present at various critical points in the proposed SENN reactor system. The methods used and general conclusions should be applicable to other OMR projects. Calculations and data on activities are included. (J.R.D.)

7129 NAA-SR-Memo-3520

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

FUEL BURN-UP STUDY OF THE U–MOLY. FUELED

HALLAM REFERENCE CORE. R. J. Doyas. Jan. 26, 1959. 6p. OTS.

Calculations were made to determine the fuel burn-up of the U–Mo fueled Hallam reference core. A peak exposure of 7000 Mwd/t, corresponding to a radial-averaged core exposure of 4400 Mwd/t, or continuous full power operation for about 1.5 years, requires a Δ k/k of 6.45%; 4.06% for burn-up + 2.39% to override equilibrium Xe and Sm poison. Sample calculations on burn-up are included. (J.R.D.)

7130 NAA-SR-Memo-4235

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CLOSED CIRCUIT COOLING WATER PURIFICATION SYSTEM. H. O. Charnock. Aug. 10, 1959. 9p. OTS.

Calculations and basic design criteria for a suitable water purification and/or treatment facility for the closed circuit cooling water system is presented. The equipment is described along with the calculation methods. Diagrams are included. (J.R.D.)

7131 NAA-SR-Memo-4420

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

FLASH DISTILLATION OF SYNTHETIC OMRE COOLANT. J. W. Florence. Oct. 6, 1959. 9p. OTS.

Continuous purification of OMRE coolant by flash distillation was investigated in bench scale experiments. The investigation showed that the OMRE continuous distillation design was not in serious error. A clear amber distillate was obtained, indicating that entrainment is not a serious problem. Results indicate that the per cent flashed is a function of the feed temperature and the flash chamber pressure. (J.R.D.)

7132 NP-8269

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

SOME REMARKS CONCERNING A MAGNETOHYDRODYNAMIC METHOD OF PROPULSION. Rudolf X Meyer. Dec. 22, 1958. 18p. Contract AF04(647)-165.

A hypothetical method of propulsion is considered, which utilizes a light-weight propellant, to which heat is transferred from a fission reactor. A magnetohydrodynamic scheme is used which—at least in principle—would allow to reach an exhaust temperature in excess of the thermal limit set by reactor technology. Lower limits are derived for the required electrical conductivity of the plasma and for the pressure ratio of the device. The results suggest that the questions concerning the conductivity of the plasma are critical and that a program designed to measure conductivities of mixtures of light-weight propellants with alkali vapors would be of considerable value. (auth)

7133 TID-10116

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

FBR QUARTERLY PROGRESS REPORT [FOR] JANUARY THROUGH MARCH 31, 1953. Nov. 1953. Decl. Oct. 7, 1959. 90p. Contract AT(11-1)-74. OTS.

Conceptual design studies are made for approaching the problem of economical central-station power production by a Pu fast-breeder reactor. It is believed that development of such a system is warranted on the basis of the following desirable characteristics: (1) operation at high specific power and temperature with consequent low critical mass; (2) appreciable breeding gain; and (3) simplified fuel fabrication and separation processes. Preliminary calculations have indicated that an external breeding-blanket configuration will be most practical for the design requirements imposed by the above considerations. A method has been developed for predicting U^{238} fast fission in fast reactors and an estimation of inelastic scattering in the core. A general outline of the proposed research program includes discussions on materials development, core and blanket separation methods, and the engineering of reactor components. (W.L.H.)

7134 YAEC-167(Vols. I and II)

Yankee Atomic Electric Co., Boston.

YANKEE NUCLEAR POWER STATION TECHNICAL INFORMATION AND FINAL HAZARDS SUMMARY REPORT. PART B, LICENSE APPLICATION, AEC DOCKET NO. 50-29. [1959]. (Vol. I, 396p. and Vol. II, 546p.). OTS.

Nuclear reactor design, plant design, site, accidents and hazards, and plant operation are considered in detail. (W.D.M.)

7135 YAEC-175

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD DECEMBER 1 TO 31, 1959. H. E. Walchli. Jan. 20, 1960. 12p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

Progress in the design and development of the Yankee Power Reactor is briefly reviewed. (For preceding period see YAEC-173.) (W.L.H.)

7136

CIRCULATION CALCULATION FOR A BOILING WATER REACTOR. [PART I]. W. Balz and R. Schwarzwilder (AEG-Kernenergieanlagen, Frankfurt am Main). Atomkernenergie 4, 469-73(1959) Dec. (In German)

A critical analysis of experimental work on the relative velocities of the mixture components reported in the German and foreign literature showed that the few results could be used in calculation on boiling water reactors only with great reservations. The measurement devices for a water-steam mixture vary according to the geometry of the reactor. Investigations on unheated water are not applicable to reactor fuel elements. Research done in America on boiling water reactors can be applied to fuel elements, but the data are unavailable or only incompletely published. Therefore a comparison of German and American research is not possible. (tr-auth)

7137

HEAT ENGINEERING OPTIMIZATION OF GAS-COOLED REACTORS. H. Benzler, R. Nitschke, and W. Schwarze (Deutsche Babcock & Wilcox Dampfkesselwerke AG, Oberhausen, Ger.). Atomkernenergie 4, 473-6(1959) Dec. (In German)

Optimum design of a gas-cooled reactor requires the design point to fall near the characteristic curve in a power-efficiency diagram. A simplified method of calculating the characteristic curve is presented, taking in account the fact that the characteristic curve is the envelope of a one-parametric family of curves. (auth)

7138

A SIMPLIFIED METHOD OF CALCULATING HEAT IN A PRESSURIZED WATER REACTOR. L. N. Muchnik (Inst. of Complex Transport Problems, Academy of Sciences, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 12, 105-9(1959) Dec. (In Russian)

A method is described for the thermal calculation of a pressurized water nuclear reactor based on the use of nomograms. Formulas for the construction of nomograms are presented. The application of nomograms is illustrated by a concrete example. (auth)

7139

COMMISSIONING DFR. J. Allen (Dounreay Experimental Reactor Establishment, Caithness, Scotland). Nuclear Eng. 5, 5-9(1960) Jan.

The designed power output from the DFR is 60 Mw(t) using uranium or plutonium as fuel and a sodium–potassium liquid-metal alloy as coolant. Testing of components in the reactor flasks and removal equipment, fuel element charging mechanism, coolant circuits, and critical assembly was carried out over a period of 50 weeks. A stringent testing program was laid down for all equipment used to transfer components in and out of the primary coolant circuit. Prior to the critical assembly 2,100 of the 2,239 channels, 1,872 for breeder elements and 367 for core elements, were charged "in air"; about 150 were charged with the element charge machine after the coolant was charged. The coolant consisted of four different compositions of NaK weighing a total of 119 tons. Enriched fuel elements containing 45.5% U^{235} were gradually inserted in place of the natural uranium elements in the approach to criticality. The elements in the outer edge of the core and in control rods were replaced first, then the interchange proceeded from the center of the core outward. The interchange of elements was begun on October 28, 1959, and criticality was reached on November 14, 1959. (B.O.G.)

7140

CONTROL CONSIDERATIONS FOR HIGH BURN-UP. R. I. Vaughan ([Atomic Energy Research Establishment, Harwell, Berks, Eng.]). Nuclear Eng. 5, 10-13(1960) Jan.

Control considerations are discussed for high burn-up power reactors operable at steady states within a large power range. The power reactor is controlled primarily by moving the control rods, by varying the coolant flow rate, and by varying the settings of the governor valves which admit steam to the turbines. Characteristic instabilities introduced by each type of control are discussed, and moderator temperature coefficients, xenon burnup, and flux depressions are indicated. (B.O.G.)

7141

SHIP PROPULSION CONFERENCE. H. L. J. Burgess. Nuclear Eng. 5, 14-18(1960) Jan.

At the Hamburg conference, November 1959, thirty-four papers were presented. The papers were divided into six main topics: General Studies and Economics; The Organic Moderated Ship Reactor; Pressurized and Boiling Water Reactors; Safety and Radiation; Gas-cooled Reactors; and Special Subsidiary Subjects. Considerations of several of the papers are presented and discussed in connection with the proposed OMR to be built in the tanker "Esso Bolivar," the first German nuclear ship. (B.O.G.)

7142

NUCLEAR CHAIN REACTIONS. (to United Kingdom Atomic Energy Authority). British Patent 817,751. Aug. 6, 1959.

After an extensive discussion of chain reactions and reactor theory, a natural-uranium reactor is described. (T.R.H.)

7143

NUCLEAR CHAIN REACTING SYSTEMS. (to United Kingdom Atomic Energy Authority). British Patent 817,752. Aug. 6, 1959.

A natural-U graphite-moderated reactor is described. (T.R.H.)

7144

NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). British Patent 817,754. Aug. 6, 1959.

A graphite-moderated fluid-cooled reactor design is described. (T.R.H.)

7145

IMPROVEMENTS IN OR RELATING TO ORGANIC REACTORS. (to North American Aviation, Inc.). British Patent 822,163. Oct. 21, 1959.

A nuclear reactor is described which is cooled, moderated, and reflected by terphenyl (m.p. 180°F). The design includes a coolant purification system and control system. Thermal power output is 120 Mw and the fuel is 1.3% enriched plate assemblies. (T.R.H.)

Research Reactors

7146 GEAP-3099

General Electric Co. Atomic Power Equipment Dept. San Jose, Calif.

DESCRIPTION AND SAFEGUARD EVALUATION OF TAIWAN OPEN POOL REACTOR. E. G. Holzmann. Mar. 20, 1959. 90p. (R-58-APE-18).

A description and safeguard evaluation of an open pool research and test reactor rated at 1000 kw are presented. The reactor is light water moderated and cooled, graphite reflected, and fueled with 3.8 kg of 20% enriched U^{235}. Forced convection cooling is used for power levels above 100 kw. Operating characteristics and procedures are given. (W.D.M.)

7147 HW-60101

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SHIELDING OF PRTR GAS LOOP AND FILTER. J. J. Regimbal. Apr. 23, 1959. 15p. OTS.

The equilibrium concentration of various fission gases associated with several possible fuel types in the Plutonium Recycle Test Reactor gas loop was determined as a function of the diffusivity of the fuel. An expression for determining the amount of radiation from a deposit of particulate fuel in the filter was derived. Graphs are presented which estimate the shielding necessary for the loop and filter. (C.J.G.)

7148 IDO-16558

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ERROR PROPAGATION IN HOT CHANNEL–HOT SPOT ANALYSIS. F. H. Tingey. Oct. 14, 1959. 18p. Contract AT(10-1)-205. OTS.

A statistical analysis of the hot spot–hot channel calculation was made. An explicit expression for hot spot wall temperatures was obtained which gives to within 5°F, in the ETR elements, that hot wall temperature which is obtained by implicit conventional procedures. Errors in factors and component terms in the hot spot calculations were estimated or postulated and propagated to the calculated wall temperature. The best estimate of hot spot wall temperature was calculated to be 320°F; and a risk of 0.02, i.e., the probability is 0.02 or less that the true wall temperature will exceed that calculated, was identified with the upper limit of 395°F which was calculated in the conventional manner. A review of the existing data on the MTR power estimate is made. An uncertainty of approximately 10% in calculated power was estimated. A graph for determining hot spot temperature under the conventional computational procedure is given. (auth)

7149 MND-LFBR-2179

Martin Co. Nuclear Div., Baltimore.

PRELIMINARY HAZARDS REPORT FOR THE LFBR CRITICAL EXPERIMENT. Dec. 1959. 154p.

Information is given for an evaluation of the Liquid Fluidized Bed Reactor (LFBR) Critical Experiment Facility addition. The site description contains analyses of the location, population, meteorology, geology, hydrology, and seismology of the CRF site. A description of the addition to the existing CRF includes a complete description of the internal and external features of the addition. The operative safeguards to be incorporated into the facility are health physics, fuel element handling and storage, exhaust air control, waste disposal, and background monitoring. An evaluation was performed to determine the potential hazards to personnel in the facility and the residential population. A 2% step input analysis is presented and shown to produce a maximum 900-Mw sec energy release. (W.D.M.)

7150 NP-8247

Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

COMANDO DE BARRAS DE CONTROL Y SEGURIDAD PARA EL REACTOR EXPERIMENTAL R A-2. Informe No. 23. (Operation of Control and Safety Rods for the R A-2 Experimental Reactor. Report No. 23). Erico Spinadel. 1959. 7p.

The control rod drive mechanism for the RA-2 Reactor is briefly described. It consists of a motor transmitting motion across an electromagnetic couple to the rack and pinion gear. The control circuit for the rod position is given. (J.S.R.)

7151 NP-8283

Lockheed Nuclear Products, Marietta, Ga.

NEUTRON AND GAMMA MAPPING WITH THE RADIATION EFFECTS REACTOR AT 1 MW. J. H. Wilson, H. H. Nichols, H. J. Jarvis, R. M. Thornton, J. K. Grant, and T. W. Ponder. Nov. 1959. 75p. Contract AF33(600)-38947. (NR-72).

Measurements were made at one megawatt to determine the gamma dose rate per watt (ergs sec^{-1} g^{-1}-$watt^{-1}$ in carbon) and the fast neutron flux per watt (neutrons cm^{-2}-$sec^{-1}watt^{-1}$ above 1.75 Mev) within the six irradiation volumes of the Radiation Effects Facility. Measurements were made at two reactor heights for each of five different reactor shield tank configurations. The data are presented in the form of curves, which show the measurements as a function of distance within the irradiation volumes. The methods and instrumentation used in obtaining these measurements are also presented. (auth)

7152 NP-8285

Lockheed Nuclear Products, Marietta, Ga.

RER SPECTRA OBTAINED WITH A MULTICRYSTAL SPECTROMETER. W. E. Austin and W. R. Champion. Nov. 1959. 25p. Contract AF33(600)-38947. (NR-77).

Relative gamma spectra were obtained twenty feet from the Radiation Effects Reactor. The measurements were made using a multicrystal spectrometer. This design incorporates pair and anticompton spectrometers in combination. Two reactor configurations were used; with shield tanks empty and water filled. The spectra were obtained before the fuel elements were run at high power. Consequently very little of the fission product spectrum is intermixed. (J.R.D.)

7153 WCAP-1161

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. PRELIMINARY CONSIDERATIONS IN THE DESIGN OF THE WESTINGHOUSE VARIABLE LOADING TEST REACTOR. J. A. Vreeland. Apr. 15, 1959. 17p. Contract AT(30-1)-2176, Task I. OTS.

A review of perturbation theory is presented specifically directed toward conclusions relevant to the design of a Variable Loading Test Reactor. This reactor is intended to produce reactivity measurements which can detect variations in fissile content of power reactor fuel elements, both with and without burnable poisons, by comparison with a standard. The perturbation theory leads to the conclusion that the effects on reactivity of the absorption of poison and of fuel in the same spectral region can be distinguished. The extent to which these two effects can be separated is dependent upon the measurement of the reactivity effects under two conditions where the ratio of the importance function of the absorption energy to the importance function of the energies of the fission spectrum is substantially different. The equations defining the importance functions are then used to note explicitly the dependence of these functions on the various reactor parameters. From this dependence is then inferred variations in these parameters which might change the functions enough to produce the separation sought. Such inferences are made for both "small" and "large" assemblies where small and large are distinguished by whether changes exterior to the assembly affect the flux and importance distribution at the center of the assembly. (auth)

7154 WCAP-6040

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. EXPERIMENTAL CONFIRMATION OF THE FEASIBILITY OF THE VARIABLE LOADING TEST REACTOR CONCEPT. J. A. Vreeland. Dec. 31, 1959. 44p. Contract AT(30-1)-2176, Task I. OTS.

A group of experiments is presented which was directed at evaluating the performance of a Variable Loading Test Reactor when used as a Reactor Fuels Measuring Facility. A parallel analytical study is presented to evaluate the effectiveness of available analytical techniques in producing comparable data. The particular experiments performed were measurements of the sensitivity to isotopic changes in a test region moderated with clean water, borated water, and air (or unmoderated), respectively. Although the test region was quite small and the applicability of the results to large regions doubtful, the results imply the ability to identify changes as small as 0.01% in the fuel content of a large assembly. This ability is independent of variations in thermal or epithermal poisons which might be made in an attempt to conceal the changes in the fuel content. The analytical results generally fall within the experimental error. The exceptions to this very good agreement are readily attributable to inadequacies in the analysis imposed by the limitations of time. (auth)

7155

RADIO-ISOTOPE PRODUCTION IN AUSTRALIA. G. R. Newman (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Atomic Energy 3, No. 1, 22-5(1959) Dec.

The radioisotope production facilities and procedures at the Australian Atomic Energy Commission's Lucas Heights Research Establishment are described. Most of the products will be made to order, as to specific activity and isotopic content. The self-service facilities allow the irradiation of a wide range of materials for periods ranging from a few minutes to many weeks, and in fluxes from about 10^{12} to about 5×10^{13} $n/cm^2/sec$ or more. The ma-

terials being irradiated are doubly-contained for purposes of safeguarding the reactor and personnel. (B.O.G.)

7156

THE SIEMENS-ARGONAUT REACTOR [(SAR)] and THE ARGONAUT REACTOR OF THE SIEMENS-SCHUCKERTWERKE AG. Gunter Hildenbrand (Siemens-Schuckertwerke AG, Erlangen, Ger.). Atomwirtschaft 4, 479-90(1959) Nov. (In German)

The first private reactor station in Federal Germany is described. It is designed after the Argonaut reactor of ANL. The description includes the reactor, the buildings and facilities, the core, reflector, shielding, experimental facilities, water and nitrogen system, instrumentation, safety devices, and physical characteristics of the reactor. (T.R.H.)

7157

CALIBRATION OF THE REGULATING RODS OF THE GEESTHACHT RESEARCH REACTOR. G. Röbert (Gesellschaft fur Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht, Ger.). Kerntechnik 1, 140-5(1959) Nov. (In German)

After a brief introduction to the principles of the method, a determination of the reactivity equivalents of the regulation, done by the "in-hour" method, is described. The single stages for the obtention of a calibration point on the differential reactivity equivalence curve of the regulating rods were shown. The reactivity equivalences of the fine control rod and of the three shim scram rods are given. The different values for the single rods are discussed. (tr-auth)

7158

THE PRINCIPAL TESTING METHODS IN THE CONSTRUCTION OF THE KARLSRUHE RESEARCH REACTOR. Emil Berger (Technischer Überwachungs-Verein, Mannheim, Ger.). Kerntechnik 1, 157-60(1959) Nov. (In German)

The methods used for quality control during the fabrication of constituent parts of the Karlsruhe Reactor are briefly described. Quality control of the construction materials during smelting, testing of piping systems, shields, forged constituents, and cast iron weld inspection, inspection of pressure vessels, and non-destructive testing of finished constituents are considered. (J.S.R.)

WASTE DISPOSAL AND PROCESSING

7159 CRT-866

Atomic Energy of Canada Ltd., Chalk River, Ont.

ON THE DISPERSION OF FISSION PRODUCTS BY GROUND WATER. T. D. Newton. Nov. 1959. 65p. (AECL-909). AECL.

On the assumptions that the motion of ions in ground water through soils may be described by reversible processes of exchange and that active ions are present in the ground water only in trace quantities, the distribution of activity through the soil of a uniform disposal area is calculated by a statistical method. The mean delay time in a uniform column is determined by the equilibrium distribution ratio, D, and the shape of the front of activity is fixed by D and a parameter N which represents the average number of transfers from the liquid to the solid state. An appendix shows the relation between the statistical methods used here and the exchange rate equation. (auth)

7160 HW-60767

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY INVESTIGATION OF ALKALINE PERMANGANATE–SODIUM ACID SULFATE FOR DECONTAMINATION OF HIGH TEMPERATURE RECIRCULATING SYSTEMS. W. A. Oldham. June 10, 1959. 8p. Contract AT(45-1)-1350. OTS.

Results of an investigation of an alkaline permanganate–sodium acid sulfate decontamination process for high-temperature recirculating systems are presented. Bench scale tests revealed consistent decontamination results equal or better than any currently used high-temperature process. The process is equally effective on activated corrosion and fission products on stainless and carbon steels. Composition specifications are given along with decontamination data and cost estimates. Corrosion data are also included. (J.R.D.)

7161 HW-61635

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOACTIVE WASTE FIXATION: RESEARCH AND DEVELOPMENT ACTIVITIES QUARTERLY PROGRESS REPORT [FOR] APRIL–JUNE 1959. D. W. Pearce, ed. June 15, 1959. 18p. Contract W-31-109-Eng-52. OTS.

Simulated waste feeds were used in 25 spray-calciner runs made to study the effect of additives on low-acid and neutralized waste calcination. Several preliminary laboratory-scale scouting runs utilizing unagitated batch calcination were performed in three-inch diameter by five-inch high stainless steel vessels. Heat transfer characteristics of various granular materials were determined in equipment designed to approximate the uniform generation of heat expected in a container of calcined waste. Runs were made with the radiant-heat spray calciner with low acid waste and TBP-25 waste. Results of the runs are reported. Experiments on the solidification of Redox waste by the addition of several additives are presented. Studies were continued to determine the feasibility of using mineral reactions to decontaminate condensate streams which may originate from fuels reprocessing plants and waste concentrating and fixation facilities. (For preceding period see HW-60584.) (W.L.H.)

7162 NAA-SR-Memo-3521a

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HBR COMBUSTION EXPERIMENT: RADIOACTIVE WASTE GAS CLEANING. E. C. Hickey. Jan. 26, 1959. 8p. OTS.

Tests were conducted to study problems associated with burning of high boiler residues from OMRE. Equipment is described and methods used are outlined. Sample calculations are included along with an evaluation of stack activity and recommendations for stack gas decontamination. (J.R.D.)

7163 AEC-tr-3949

STUDY OF THE FIXATION AND MIGRATION OF RADIOACTIVE CATIONS IN A NATURAL ION EXCHANGER. (Etude de la Fixation et de la Migration de Cations Radioactifs dans un Echangeur D'ions Naturel). L. Baetsle. Translated for Oak Ridge National Lab. from French Atomic Energy Commission Report of Oct. 1959. 61p. (includes orig., 35p.). JCL.

In order to utilize lignite as a natural ion exchanger in the treatment of residual radioactive water, a study of its physical and physicochemical properties was carried out as they relate to ion exchange. A survey of the physical and chemical properties is given in the first part. In the

second part, the distribution of Sr^{90} and Cs^{137} ions in the presence of Ca and Na is studied and the equilibrium constants are calculated. The kinetics of ion fixation is discussed in the third part, where a few necessary parameters for the calculation of ion exchanger beds have been established. The plans for the study of the migration of radioactive ions in the soil is briefly sketched in the last part. (auth)

7164 AEC-tr-3953

UTILIZATION OF A VERGIÈRE SAMPIE FOR THE STUDY OF THE POSSIBLE CONTAMINATION OF LOCAL SOILS BY RADIOELEMENTS. SECOND PROGRESS REPORT. (Utilisation du Prelevement Vergiere pour L'Etude de la Contamination Eventuelle des Sols En Place Par Les Radioelements. Deuxième Rapport d'activité). J. Bourrier and A. Grauby. Translated for Oak Ridge National Lab. from French Atomic Energy Commission Report of Oct. 20, 1959. 44p. JCL.

A procedure is described for using soil samples under different moisture conditions to obtain qualitative information on the phenomena involved during the passage of a solution of strontium-90–yttrium-90 through the soil. Experimental results are included. (C.H.)

7165

VAPORIZATION AS A METHOD FOR THE DECONTAMINATION OF RADIOACTIVE WASTES. [PART III]. S. Krawczynski (Kernreaktor Bau- und Betriebs-Gesellschaft m.b.H., Karlsruhe, Ger.). Kerntechnik 1, 145-9(1959) Nov. (In German)

The perturbation of the decontamination effectiveness of the evaporation method by the presence of volatile or gaseous radioactive constituents in the waste water, as the presence of radioiodine, ruthenium tetraoxide, argon, xenon, krypton, or radon, is considered. A comparison of the evaporation method with other decontamination methods is given. (tr-auth)